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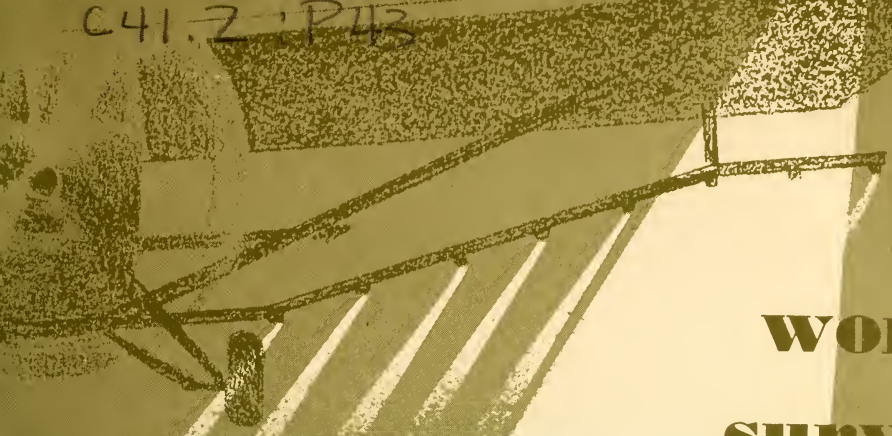

world survey of pest control products

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world survey of pest control products

by Laura G. Arrington

under supervision of
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Foreword

This world survey of the pesticide industry is the first of its kind in scope and comprehensiveness, covering all segments and phases of the industry in the United States and 66 foreign countries. Included are data on production, consumption, foreign trade, marketing methods, distribution patterns, advertising media, application equipment, and government regulations relating to pesticides. Prospects for increasing United States participation in foreign markets are analyzed.

The survey is the result of much thought, planning, and effort on the part of both Government and industry. Because of the rapid growth, diversification, and great capacity of the industry, many individual producers and the trade associations of the industry have urged the undertaking of the project.

During and since the Korean conflict, United States capacity for production of various pesticides has increased to such a degree that potential output cannot be absorbed by domestic requirements. Output of toxic ingredients for pesticides in 1955 at producers level was estimated to be $200 million and installed capacity is perhaps twice as great. Total exports (basic pesticides plus formulated products), valued at $63 million in 1954, in 1955 attained an all-time high of $79 million.

Production of basic pesticides abroad has also increased in recent years, especially in Central European countries, and keen competition exists in world markets.

The material on foreign countries was obtained from commodity and economic reports submitted by the Foreign Service of the United States in response to a questionnaire sent out in 1954, from official data supplied by foreign governments, and from industry sources. (The Foreign Service reports which form the basis for this study are on file in the Chemical and Rubber Division and may be consulted by interested persons.) The Bureau of Foreign Commerce cooperated in supplying foreign trade statistics. The section on the United States was compiled from information available in the Chemical and Rubber Division, plus statistics from the Bureau of the Census, the Bureau of Mines (U. S. Department of the Interior), and the United States Tariff Commission.

Because of time consumed in obtaining replies to the questionnaire, and in preparing the manuscript for publication, most statistical data

refer to 1953 and 1954. However, it has been possible to include 1955 statistics on United States production and exports of pesticides.

World Survey of Pest Control Products was prepared in the Chemical and Rubber Division by Laura G. Arrington under the direction of C. C. Concannon. Members of the staff who contributed to the work include Louise Evans and Virginia Kinnard.

The results of this survey and the reference data in the publication are of special interest to various agencies of the U. S. Government. Public health programs abroad have grown in scope in recent years and it is essential that Government agencies be informed on the availability of materials for control of malaria and typhus, for example, in order to implement properly projects in which this country participates.

It is believed that this reference work will prove useful to the chemical industry, the small business man, and the business community at large.

CHAS. F. HONEYWELL, *Administrator,*
Business and Defense Services Administration.

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Glossary

Until 1955, coined names for pesticides were approved by an Interdepartmental Committee on Pest Control consisting of representatives of the U. S. Departments of Agriculture, Interior, Army, Navy, Air Force, and Health, Education, and Welfare. Approval for coined names is now within the jurisdiction of the American Standards Association Sectional Committee on Common Names for Pest Control Chemicals, K62. The National Agricultural Chemicals Association, 1145 19th Street, NW., Washington, D. C., publishes lists of coined names as they are approved.

There follows a partial list of coined names for pesticides, with their chemical formulas.

Coined Name	*Chemical Formula*
Aldrin	1,2,3,4,10,10 - hexachloro - 1,4,4,5,8,8a - octohydro-1,4,5,8-dimethanonaphthalene
Allethrin	DL-2-allyl-4-hydroxy-3-methyl-2-cyclopenten - 1-one esterfied with a mixture of cis and trans DL-chrysanthemum monocarboxylic acid (allyl homolog of Cinerin I)
ANTU	Alphanaphthyl thiourea
Aramite	2-(p-tert-butylphenoxy) isopropyl-2-chloroethyl sulfite
BHC (benzene hexachloride)	1,2,3,4,5,6-hexachlorocyclohexane
Captan	N-trichloromethylthiotetrahydrophthalimide
Chlordane	1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a tetrahydro-4,7-methanoindane
Chlorothion	0,0-dimethyl-0-3-chloro-4-nitrophenyl thiophosphate
Coumachlor	3-(alpha - acetonyl - 4 - chlorobenzyl)-4-hydroxycoumarin
Cyclethrin	3-(2-cyclopenthyl) 2-methyl-4-oxo-cyclopenthyl chrysanthemum monocarboxylate
DDT	Dichlorodiphenyl trichloroethane
DDVP	Dimethyl dichloro vinyl phosphate
Diazinon	0,0-diethyl-0-(2-isopropyl-4-methyl - pyramidyl (6))
Diclone	2,3-dichloro 1,4-naphthoquinone
Dieldrin	1,2,3,4,10,10-hexachloro-6,7-epoxy - 1,4,4a,5,6,7,8,8a-octohydro-1,4,5,8-dimethanonaphthalene
Dipterex	0,0-dimethyl 1-hydroxy-2,2,2-trichloroethyl phosphonate
Dithane	Disodium ethylene bisdithiocarbamate

Coined Name	*Chemical Formula*
Endrin	1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-endo dimethanonaphthalene
EPN	Ethyl p-nitrophenyl thiono benzenethiophosphonate
Estomite	Parachlorophenyl parachlorobenzene sulfone
Ferbam	Ferric dimethyl dithiocarbamate
Glyodin	2-heptadecyl-2-imidazoline glyomaldine
Heptachlor	1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a tetrahydro-4,7-methanoindane
HETP	Hexaethyl tetraphosphate and tetraethyl pyrophosphate
IPC	Isopropyl-N-phenyl carbamate
Isodrin	1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a - hexahydro-1,4,5,8-endo-endo-dimethanonaphthalene
Karathane	Dinitro capryl crotonate
Lethane	Beta butoxy beta thiocyano diethyl ether
Lindane	Not less than 99 percent of the gamma isomer of benzene hexachloride
Malathion	0,0-dimethyl dithiophosphate of diethyl mercaptosuccinate
Maneb or Manzate	Manganese ethylenebisdithiocarbamate
MCP	2,methyl-4-chlorophenoxyacetic acid
Methoxychlor or Marlate	1,1,1-trichloro-2,2-bis (p-methoxyphenyl) ethane
Nabam	Disodium ethylene bisdithiocarbamate
Ovatran	Parachlorophenyl parachlorobenzene sulfonate
Panogen	Methylmercury dicyandiamide
Parathion	0,0-diethyl-0-p-nitrophenyl thiophosphate
Perthane	1,1-dichloro-a,a-bis(p-ethyl-phenyl) ethane
Pival	2,pivalyl-1,3-indandione
Pyrenone	Emulsifiable combination of pyrethrins and piperonyl butoxide
Strobane	Terpene polychlorinates, consisting of camphene, pinene, and related terpene polychlorinates
Systox	0-2-(ethylmercapto) ethyl 0,0-diethyl thiophosphate
TCA	Trichloroacetic acid
TDE or DDD	Contains a hydrogen in place of one of the chlorines on the ethane radical of DDT
TEPP	Tetraethyl pyrophosphate
Thanite	Isobornyl thiocyanoacetate
Thiram	Tetramethylthiuram disulfide
Toxaphene	A chlorinated camphene
2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
Warfarin	3-(alpha-acetonylbenzyl)-4-hydroxycoumarin
Zineb	Zinc ethylene bisdithiocarbamate
Ziram	Zinc dimethyl dithiocarbamate

North America and the Caribbean Area

The United States is the largest world manufacturer and supplier of pest-control products. Capacity for annual production exceeds normal domestic consumption and increased exports are desirable.

With the exception of the United States, Canada, and Mexico, countries in North America and the Caribbean area do not manufacture basic pesticides, and little formulating is done. This area continues to be the biggest foreign market for United States pesticides. Exports to the area rose from $24,413,000 in 1953 to $27,216,000 in 1954, and for 1955 totaled $34,464,000.

UNITED STATES

Production

Growth of the United States pesticide industry in the past decade has been tremendous, both in quantity of output and variety of products, and has resulted in this country's becoming the largest world manufacturer and supplier.

Prior to World War II, manufacture of pesticides consisted largely of inorganic products such as calcium arsenate, lead arsenate, paris green, copper sulfate, fluorine compounds, and ground sulfur, along with the botanical insecticides—pyrethrum dust and extract, rotenone dust, and nicotine sulfate. Since the advent of DDT, the trend has been toward organic compounds, and each year a number of new insecticides, fungicides, weedkillers, and the like enter the market.

A distinct advantage in increased manufacture of synthetic organic pesticides lies in the domestic availability of basic materials needed for their production. The United States is dependent to some extent on imports of arsenic and lead (for lead arsenate), and pyrethrum and rotenone are entirely of foreign origin.

The Census of Manufactures valued 1939 production of all pesticides at $76 million. According to the United States Tariff Commission, sales of synthetic organic pesticides alone totaled $150 million in 1951, $133 million in 1952, $118 million in 1953, and $124 million in 1954.

Table 1.—*United States Production and Imports of Principal Pesticide Materials, 1945–55*

[Thousands of pounds]

Commodity	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955 (preliminary)
PRODUCTION											
White arsenic	48, 698	31, 006	37, 510	37, 278	25, 590	26, 546	32, 380	31, 346	21, 746	26, 334	n. a.
Calcium arsenate	25, 644	35, 394	46, 904	27, 234	16, 006	45, 348	40, 900	7, 634	7, 260	2, 758	3, 030
Lead arsenate	70, 522	56, 667	31, 006	24, 630	16, 866	39, 434	25, 416	14, 286	14, 196	15, 620	14, 776
Copper sulfate	251, 000	255, 600	178, 200	193, 400	158, 000	174, 600	213, 872	189, 072	145, 888	130, 616	156, 176
BHC (100% gamma basis)	n. a.	n. a.	n. a.	2, 212	3, 787	10, 200	17, 100	12, 800	8, 800	11, 500	10, 161
DDT (100% basis)	33, 243	45, 651	49, 600	20, 240	43, 700	78, 150	106, 140	99, 929	84, 366	97, 198	125, 134
Parathion	n. a.	n. a.	n. a.	n. a.	n. a.	[1] 2, 625	4, 631	2, 365	2, 999	3, 899	5, 000
TEPP (tetraethyl pyrophosphate)	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	1, 870	922	229	361	n. a.
2,4-D acid	917	5, 466	5, 629	21, 889	15, 106	14, 156	17, 671	30, 718	25, 928	30, 134	34, 070
2,4,5-T acid	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	[1] 2, 454	3, 490	5, 281	2, 697	3, 000
Miscellaneous organic pesticides [2]	n. a.	n. a.	n. a.	n. a.	n. a.	45, 000	75, 000	65, 000	50, 000	65, 000	110, 000
IMPORTS											
Pyrethrum flowers	18, 270	20, 476	8, 082	3, 633	10, 160	8, 268	6, 902	6, 878	7, 850	6, 883	8, 000
Rotenone-bearing roots	8, 820	11, 369	13, 413	4, 713	7, 716	10, 010	6, 263	2, 853	5, 643	6, 325	5, 400
White arsenic	26, 298	27, 606	27, 880	18, 672	9, 393	29, 547	29, 037	8, 967	9, 434	9, 696	14, 430

n. a. Not available.

[1] Partly estimated.

[2] Includes such commodities as allethrin, aramite, aldrin, chlordane, dieldrin, dithiocarbamate fungicides, lindane, methoxychlor, malathion, toxaphene, endrin, captan, etc.

Sources: Bureau of the Census, U. S. Department of Commerce; Bureau of Mines, U. S. Department of the Interior; U. S. Tariff Commission; and (for miscellaneous organic pesticides) material in Chemical and Rubber Division files.

However, these figures do not give a complete picture of pesticide production. It has been estimated that manufacture of all basic pesticide toxicants (not including formulations) at the manufacturers level was valued at $160 million in 1953, $175 million in 1954, and probably will top $190 million in 1955. (For statistics on output of individual pesticide materials in recent years see table 1.)

Consumption

The use of pesticides is increasing not only in volume but in variety, and application of specialized products for specific controls is becoming more general. In number of compounds available for control of various insects, fungi, weeds, and the like the pesticide field has expanded more in the past 10 years than during all previous years of its history, and the list is ever increasing. Constant research is being conducted, both by government agencies and private corporations, to discover and test chemical compounds for effectiveness as insecticides, fungicides, weedkillers, and other purposes, particularly for specific controls.

Only within recent years have such materials as defoliants been used on plants such as cotton, potatoes, and soy beans. Selective weedkillers have come into common use only within the past decade, particularly on small grains. Pre-emergence weedkillers also are becoming popular. Use of herbicides not only increases output per acre, but reduces the number of man-hours required for a unit of production, thus alleviating to some degree the shortage of farm labor.

A rapidly growing market for pesticides lies in protection of stored grain. The United States Department of Agriculture and the Food and Drug Administration, United States Department of Health, Education, and Welfare, are uniting forces in this project which will save thousands of tons of grain as well as provide the public with noninfested cereal products.

Also, for control of livestock pests, there are a number of new materials, use of which results in added weight of beef cattle and hogs and increases milk production. Use of various new organic insecticides has been a big factor in control of flies and other household insects, as well as in lessening infestations around barns, dairies, and other outbuildings.

Through cooperation of the United States Public Health Service and State and municipal authorities, incidence of malaria has been practically eradicated in the United States. Furthermore, United States Government and municipal authorities have cooperated on a number of successful rat-eradication programs.

Table 2 gives domestic disappearance of some major agricultural pesticides in recent crop years. However, these statistics do not take into consideration the ever-growing use of newer commodities,

Table 2.—*United States Domestic Disappearance at Producers Level of Some Major Pesticides by Crop Years, 1950–51 to 1953–54* [1]

[Thousands of pounds]

Commodity	1950–51	1951–52	1952–53	1953–54
Benzene hexachloride [2]	9, 600	11, 067	7, 085	7, 610
Calcium arsenate	39, 583	4, 735	7, 000	3, 190
Copper sulfate [3]	122, 449	98, 182	79, 582	74, 054
2,4–D (acid basis) [4]	23, 494	25, 298	26, 122	26, 483
DDT	72, 688	70, 074	52, 748	45, 117
Lead arsenate	30, 174	17, 452	16, 000	16, 000
Parathion	4, 670	4, 511	3, 000	3, 975
Pyrethrum (flowers) [5]	7, 098	6, 729	8, 113	7, 679
Rotenone (roots) [5]	7, 027	3, 520	4, 468	6, 428
2,4,5–T (acid basis) [4]	2, 822	2, 937	4, 625	[6] 3, 877

[1] Based on available information; crop year is from Oct. 1 through Sept. 30.
[2] Gamma isomer basis; includes lindane.
[3] Disappearance for all domestic uses, including industrial; calendar-year basis.
[4] Export data not being reported separately, figures represent total disappearance at producers level.
[5] Imports; includes advanced (powdered), also equivalent of pyrethrum extract imported in 1953–54.
[6] Production for calendar year 1954, as reported by the U. S. Tariff Commission.

Source: *The Pesticide Situation for 1954–55.* Commodity Stabilization Service, U. S. Department of Agriculture.

such as aldrin, dieldrin, endrin, toxaphene, aramite, captan, malathion, and the dithiocarbamate fungicides, which probably accounted for about one-sixth of 1954 consumption of pesticides.

Foreign Trade

Imports of pesticides into the United States are negligible, except for such raw materials as arsenic (for manufacture of the arsenates), pyrethrum flowers and extract, and rotenone-bearing roots.

Export markets for pesticides have risen tremendously in recent years. For instance, from $4,975,000 in 1939, they had risen to $18,505,000 by 1945; by 1953 were $49,060,000; in 1954 rose to $62,740,000; and in 1955 totaled $79,133,000. (See table 3 for exports of all pesticides to areas and principal countries of destination in 1945 and 1953–55.)

Equipment

The latest and most efficient equipment for application of pesticides is used in the United States, and supplies of all types are plentiful. In recent years, spraying and dusting by aircraft has become a common practice. The following information on such application is summarized from *The Airplane at Work for Business and Industry,* published in December 1954 by the Civil Aeronautics Administration of the Department of Commerce.

Aerial pesticide application began in 1919 when the United States Department of Agriculture aerially dusted fruit trees infested with caterpillars. Aerial control is now used on more than 200 crops. It is

estimated that at present 1 of every 12 acres under cultivation is treated from aircraft.

In 1953, commercial agricultural flying totaled 722,300 hours by 4,090 aircraft, with between two-thirds and three-fourths of flying time consisting of pesticide dusting and spraying operations. Dusting operations consumed 266,800 hours, and included dusting 13,476,000 acres of cotton with 235,229,000 pounds of finished dust. Flying hours for spraying of forest and crop areas totaled 262,200, with 17,188,000 acres being sprayed and over 47 million gallons of liquid used. Chemicals dispersed as spray included insecticides, fungicides, weedkillers, defoliants, and plant hormones. In 1953, hours spent in dusting were 6 percent below those in 1952, while hours spent in spraying were 20 percent higher. If present chemical treatments remain essentially unchanged, spraying will probably continue to grow and may become more important than dusting.

Aircraft were flown approximately 50,000 hours in applying defoliants in 1953. Both spraying and dusting are used to distribute these chemicals, which are used principally in the cotton area.

Application of growth regulators in aerial sprays is one of the newer uses of importance in fruit-raising areas. These plant hormones can be sprayed on trees to obtain a good "set" of fruit or to thin the fruit, either of these being applied at blossom time, while a third hormone may be applied near harvest time to prevent ripe fruit from dropping.

Minor uses of aircraft for application of pesticides include, among others, spraying of towns with insecticides to control flies, mosquitoes, and other insects; aerial distribution of poison bait to control grasshoppers; and control of algae in flooded rice fields.

Marketing and Distribution

United States marketing and distribution of pesticides are carried out by producers, formulators, wholesalers, farm cooperatives, such organizations as the National Grange, and retailers of various types—feed and seed stores, agricultural supply houses, and grocery and drug stores (for household and garden pesticides). The larger producers and formulators employ numerous traveling salesmen and agents to promote their particular products.

The Department of Agriculture, in cooperation with State authorities and organized groups of individuals, aids in controlling infestations of grasshoppers and mormon crickets on rangelands. The Federal Government also carries on projects to control insects in national forests and parks. In case of heavy infestations of armyworms or other pests, Department of Agriculture personnel advise State authorities and individual farmers concerning pesticide use. The Department of Health, Education, and Welfare distributes insecticides

Table 3.—*Total United States Exports of Pesticides, by Areas and Principal Countries of Destination, 1945 and 1953–55*

[Quantity in thousands of pounds; value in thousands of dollars]

Area and principal countries of destination	1945		1953		1954		1955 (preliminary)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
North America:								
British Honduras	20	$4	37	$13	39	$18	79	$21
Canada	9, 483	1, 375	33, 228	7, 490	27, 191	7, 777	26, 071	8, 514
Canal Zone	94	13	169	66	210	71	160	39
Costa Rica	8, 122	405	3, 870	560	2, 644	776	19, 824	2, 427
Guatemala	17, 187	855	17, 075	1, 767	17, 749	1, 984	13, 588	1, 762
Honduras	14, 026	714	25, 973	2, 644	23, 157	2, 432	21, 843	2, 539
Mexico	8, 598	939	48, 898	6, 490	39, 090	6, 325	62, 130	11, 145
Nicaragua	137	19	5, 682	1, 086	18, 530	3, 541	18, 617	4, 067
Panama	8, 121	408	10, 450	1, 056	2, 370	384	13, 387	1, 583
El Salvador	470	45	5, 333	1, 042	10, 711	1, 794	13, 108	2, 361
Other [1]	50	13						
Total [2]	66, 308	4, 792	150, 720	22, 670	141, 700	25, 108	188, 807	34, 464
South America:								
Argentina	4, 293	507	838	260	2, 325	939	2, 964	1, 300
Bolivia	604	41	172	41	326	87	158	43
Brazil	5, 022	720	10, 826	2, 619	20, 771	4, 529	17, 071	5, 231
Chile	263	67	1, 524	546	1, 087	222	391	192
Colombia	3, 392	348	12, 580	2, 060	19, 155	3, 250	14, 615	3, 301
Ecuador	217	32	1, 048	365	1, 029	342	733	280
Paraguay	103	14	83	24	97	41	8	4
Peru	3, 753	286	11, 166	1, 405	9, 880	1, 385	7, 386	2, 051
Surinam	92	13	235	64	247	64	169	54
Uruguay	436	92	429	97	656	151	992	325
Venezuela	2, 085	392	7, 351	2, 463	9, 821	3, 349	9, 587	3, 015

Other [1]	33	7	71	15	30	9	25	10
Total [2]	20, 290	2, 520	46, 325	9, 960	65, 430	14, 372	54, 099	15, 805
Caribbean Area:								
British West Indies	338	45	295	87	295	117	273	89
Cuba	3, 323	500	5, 879	1, 307	7, 112	1, 553	6, 127	1, 606
Dominican Republic	237	28	820	115	1, 675	161	3, 381	380
French West Indies	70	10	6	2	23	10	19	9
Haiti	855	50	335	116	195	42	81	17
Netherlands Antilles	187	42	252	93	210	61	190	98
Trinidad and Tobago	140	25	50	23	216	160	940	357
Total [2]	5, 152	702	7, 640	1, 743	9, 730	2, 108	11, 011	2, 556
Europe:								
Austria			31	11	59	41	5	5
Belgium and Luxembourg	4	2	470	185	395	250	703	521
Denmark			121	47	201	91	297	236
Finland			47	25	50	30	67	48
France	4, 695	244	912	302	885	468	2, 161	1, 181
Germany, East					113	39		
Germany, West			250	170	663	275	490	329
Greece	316	66	171	55	2, 453	455	1, 065	216
Italy	1, 171	115	1, 360	650	1, 385	770	1, 027	579
Netherlands	29	21	795	250	1, 397	505	1, 708	600
Norway	22	21	206	91	264	150	247	129
Portugal	69	24	101	45	80	39	72	46
Spain	155	21	12	4	241	93	845	606
Sweden	181	45	192	78	563	259	729	324
Switzerland	54	6	309	253	390	298	276	216
Turkey	898	62	4, 865	1, 160	5, 494	1, 256	3, 829	957
United Kingdom	310	107	250	135	807	412	815	450
Other [1]	[3] 4, 705	475	90	30	18	13	37	17
Total [2]	12, 600	1, 210	10, 175	3, 485	15, 460	5, 446	14, 374	6, 463

See footnotes at end of table.

Table 3.—*Total United States Exports of Pesticides, by Areas and Principal Countries of Destination, 1945 and 1953–55*—Continued

[Quantity in thousands of pounds; value in thousands of dollars]

Area and principal countries of destination	1945		1953		1954		1955 (preliminary)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Asia and Oceania:								
Afghanistan	5	1	229	85	84	26	133	44
Australia	1, 000	620	342	176	670	435	300	322
British Malaya	32	3	30	25	85	56	208	117
Burma			540	210	667	208	706	237
Ceylon	60	42	340	157	490	325	83	25
French Pacific Islands	29	1	72	40	71	49	87	47
Hong Kong			35	15	18	16	25	23
India	6, 148	7, 059	7, 076	2, 580	11, 827	4, 167	11, 779	4, 498
Indochina			505	125	150	73	356	148
Indonesia	949	92	3, 470	740	3, 895	1, 146	4, 990	1, 813
Iran	79	36	1, 061	437	2, 692	946	1, 757	708
Iraq	81	11	235	85	356	150	1, 328	517
Israel and Palestine	648	43	746	190	448	277	332	304
Japan			2, 035	1, 592	1, 305	991	1, 424	1, 412
Korea			2, 355	265	3, 330	790	2, 618	1, 027
Lebanon			407	67	768	165	744	123
Nansei Islands					75	42	126	26
New Zealand	312	88	85	30	87	55	591	304
Pakistan	(4)	(4)	1, 281	463	2, 175	1, 340	891	745
Philippine Republic	253	48	3, 326	978	2, 140	610	2, 983	924
Saudi Arabia	68	19	336	150	334	91	469	217
Syria	154	19	406	85	411	100	258	51
Taiwan			490	165	581	211	179	132
Thailand			865	280	926	290	875	280
Other [1]	[5] 906	144	85	15	170	16	229	31
Total [2]	10, 726	8, 225	26, 340	8, 955	33, 760	12, 570	33, 469	14, 075

Africa:								
Angola	39	6	57	16	82	18	87	28
Algeria	217	43	445	62	1, 238	131	143	45
Belgian Congo	107	18	6, 220	645	5, 232	621	9, 669	1, 173
British East Africa	107	21	38	14	148	96	200	70
Cameroons	50	7	93	53	588	179	400	130
Egypt	2, 024	226	576	166	1, 303	221	3, 077	371
French Morocco	139	24	435	150	473	167	790	320
French West Africa	22	6	150	57	207	63	848	389
Liberia	10	3	500	71	502	74	517	82
Madagascar	8	2	1	1	69	32	4	2
Mozambique	166	26	181	71	1, 464	125	257	130
Nigeria	49	6	238	25	9	7	28	15
Rhodesia and Nyasaland	105	25	1, 091	90	490	100	1, 468	236
Tunisia	14	3	116	9	42	19	56	25
Union of South Africa	3, 517	584	1, 924	716	2, 824	943	3, 931	1, 343
Other [1]	189	57	200	35	104	31	[6] 382	100
Total [2]	6, 766	1, 060	12, 260	2, 185	14, 775	2, 830	21, 855	4, 465
Estimated shipments valued at $100 to $499, as reported by the Bureau of the Census			191	46	995	306	4, 527	1, 311
Grand total	121, 853	$18, 505	253, 697	$49, 060	281, 860	$62, 740	328, 131	$79, 133

[1] Includes those countries to which less than $10,000 worth were shipped in each of these periods.

[2] Because the figures are rounded, the sum of the columns, in many cases, will not exactly add to the totals.

[3] Includes 227,000 pounds of copper sulfate to USSR; 2,600,000 pounds of copper sulfate to Yugoslavia; 325,000 pounds of household and industrial insecticides to Yugoslavia; and 1,236,000 pounds household and industrial insecticides to Poland and Danzig.

[4] Included with India.

[5] Includes the following shipments to China (in pounds): 101,000 of lead arsenate, 100,000 calcium arsenate, 121,316 miscellaneous agricultural insecticides and related materials, and 544,155 of household and industrial insecticides.

[6] Includes 251,000 pounds ($54,000) to Anglo-Egyptian Sudan.

Source: Bureau of the Census, U. S. Department of Commerce.

for malaria control, for use in any threatened epidemic such as typhus, and for rat-eradication programs.

Commercial exports of pesticides—an important segment of the United States market—are made by producers, manufacturers' agents, export companies, brokers, etc. Various Government agencies, including General Services Administration, and the State Department, and such organizations as the World Health Organization and the Pan American Sanitary Bureau purchase pesticides, on bid, for shipment abroad for public health purposes, locust control, agricultural demonstrations, and for general foreign aid to underprivileged countries.

Advertising of pesticides in the United States is conducted by the most modern methods. Media employed include full-page color advertisements in not only agricultural magazines but periodicals read by the general public; articles and news items on new products; movies; television; posters; billboards; and store displays. The United States pesticide industry is highly competitive and considerable sums are spent on advertising particular brands and trademarked commodities.

Government Decrees and Regulations

Interstate commerce in "economic poisons"—insecticides, fungicides, weedkillers, rodenticides, and related materials—is regulated by the Federal Insecticide, Fungicide, and Rodenticide Act of 1947. This regulation, enforced by the Secretary of Agriculture, requires that all pesticides entering interstate commerce be approved by and registered with the Department of Agriculture. Such registration requires the name and address of the registrant; the name of the economic poison; a complete copy of the label to appear on packages; a statement of all claims made for the commodity; and directions for use. Also, if requested by the Secretary of Agriculture, a full description of tests made and results thereof upon which the claims are based must be submitted. (For interpretations of this act, see Service and Regulatory Announcement No. 167, issued by the Department of Agriculture, August 1948 (slightly revised March 1950), entitled "Interpretations of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.")

In 1954, Public Law 518 (known as the Miller bill) amended the Federal Food, Drug, and Cosmetic Act with respect to residues of pesticide chemicals in or on raw agricultural commodities. The act contains the following regulations:

> Any poisonous or deleterious pesticide chemical, or any pesticide chemical which is not generally recognized, among experts qualified by scientific training and experience to evaluate the safety of pesticide chemicals, as safe for use, added to a raw agricultural commodity, shall be deemed unsafe for the purpose, unless:
>
> (1) A tolerance for such pesticide chemical in or on the raw agricultural commodity has been prescribed by the Secretary of Health, Education, and Welfare

under this section and the quantity of such pesticide chemical in or on the raw agricultural commodity is within the limits of the tolerance so prescribed; or

(2) With respect to use in or on such raw agricultural commodity, the pesticide chemical has been exempted from the requirement by the Secretary of Health, Education, and Welfare . . .

Any person who has registered, or who has submitted an application for the registration of, an economic poison under the Federal Insecticide, Fungicide, and Rodenticide Act may file with the Secretary of Health, Education, and Welfare, a petition proposing the issuance of a regulation establishing a tolerance for a pesticide chemical which constitutes, or is an ingredient of, such economic poison, or exempting the pesticide chemical from the requirement of a tolerance. The petition shall contain data showing: The name, chemical identity, and composition of the pesticide chemical; the amount, frequency, and time of application of the pesticide chemical; the results of tests on the amount of residue remaining, including a description of the analytical methods used; practical methods for removing residue which exceeds any proposed tolerance; proposed tolerances for the pesticide chemical if tolerances are proposed; and reasonable grounds in support of the petition.

Samples of the pesticide chemical shall be furnished to the Secretary of Health, Education, and Welfare upon request.

The Department of Agriculture has two legal functions in enforcing the above law on tolerances. First, through the Plant Pest Control Branch of the Agricultural Research Service, the Department will determine for the Food and Drug Administration whether an insecticide or other economic poison is useful for the purpose for which a residue tolerance or exemption is sought. Second, the Department will give the Food and Drug Administration (which operates under the Department of Health, Education, and Welfare) its opinion concerning the residues likely to result from the proposed use of the pesticide. Requests for certification of usefulness should be made in writing to the Chief, Plant Pest Control Branch, Agricultural Research Service, United States Department of Agriculture, and should be made only on pesticides which have been registered, or submitted to the Department of Agriculture for registration, as economic poisons under the Federal Insecticide, Fungicide, and Rodenticide Act. Requests must be supported by reports of all experimental work done to determine the effectiveness and usefulness of the pesticide.

In addition to these Federal regulations each State has individual laws governing sale and distribution of pesticides, and each year, as new products come into commercial use, added legislation is enacted.

Prospective Developments and Trends

Percentagewise, capacity for production of pesticide materials probably will not increase in volume at so great a rate in the next 10 years as it has in the past decade. Present facilities for manufacture of such products as DDT, benzene hexachloride, calcium

and lead aresenates, copper sulfate, and some of the specialized commodities produced by only 1 or 2 firms are greater than required to meet domestic consumption and export demand. However, new pesticide materials are constantly being discovered, tested, found effective for particular uses, and eventually produced in commercial quantities. The trend is definitely toward specialized products for specific purposes, and future expansion in production undoubtedly will be along this line.

Overall consumption of pesticides in the United States has been rising for a number of years. With the decrease in farm acreage in many areas and the shortage of farm labor, there is need for much greater use in order to meet rising demands for agricultural products by the ever-increasing population. The degree of increase is largely dependent on education of farmers regarding the benefits to be derived, such as greater monetary returns per acre and lessened labor.

According to Mr. Lea S. Hitchner, executive secretary of the National Agricultural Chemicals Association, "We (the pesticide industry) have created a broad market for pesticides which is here to stay and which is becoming less and less seasonal in nature as the scope and use of our products are broadened . . . We are in the best position in our history to supply the most effective and widest choice of materials ever known in the entire history of agriculture . . . Not only does the situation in agriculture today present a real opportunity for those who wish to sell chemical aids to agriculture, but no other industry is competing directly with the pesticide industry in this market . . ."

In spite of increasing manufacture of pesticides in many industrialized countries of the world and keen competition in export markets, particularly from West Germany and other European countries, United States exports of pesticides have shown a steady increase for many years. Value of 1955 exports exceeded that of all former years. It appears that a particularly promising export market exists in miscellaneous agricultural insecticides and related materials, which includes specialized pesticides, many of which are not produced outside the United States. Value of exports in this category rose from $24,526,000 in 1954 to $32,026,000 in 1955, an increase of 30 percent.

CANADA

(Based on report by L. Schaffner, U. S. Embassy, Ottawa)

Production

The Dominion Bureau of Statistics in 1954 published an excellent study on Canadian consumption and imports of pest-control products,

but published figures on production and exports are not complete. This lack of data on output of pesticides is due chiefly to the fact that many commodities are manufactured by only one firm and production statistics on individual firms cannot be released. (See table 4 for data on Canadian production of pesticides.)

Table 4.—*Production of Pesticides in Canada, 1951–52*

[Selling price at works in Canadian dollars]

Commodity	1951	1952
DDT	$1, 224, 221	$1, 696, 626
Agricultural dusts and sprays, not specified elsewhere	1, 668, 226	1, 181, 356
Moth repellant	542, 858	663, 564
Livestock spray and powder	386, 181	322, 394
Fly sprays	172, 424	149, 481
Rat and mouse poisons	82, 973	153, 804
Gopher poison	61, 742	37, 653
Other household insecticides	288, 735	566, 964
Weedkillers	2, 160, 846	2, 943, 189

Source: *Chemicals and Allied Products, 1951*, published Jan. 22, 1954, by The Dominion Bureau of Statistics, Ottawa.

Production of raw materials for manufacture of pest-control products is limited to some half-dozen materials, most of which are manufactured by Naugatuck Chemical Co. (a division of the Dominion Rubber Co.), Elmira, Ontario. Certain solvents are produced by Canadian refineries. Diluents, such as diatomaceous earth and talcs, are available in Canada. Some copper sulfate is produced at Trail, British Columbia, by the Consolidated Mining & Smelting Co. of Canada, Ltd., and by Canadian Copper Refiners, Montreal. A limited quantity of certain other products, such as lead arsenate and calcium arsenate, probably also is produced.

With the exception of Naugatuck Chemicals, Canadian "producers" of pesticides are formulators only. Around 50 formulators are registered, the majority being subsidiaries of United States firms.

Consumption

Table 5 gives detailed statistics on sales of pest-control products by Canadian registrants in 1952 and 1953. This annual survey, conducted by the Dominion Bureau of Statistics, indicates that since 1947 (when sales data were first compiled), there has been a steady advance in total sales value of more than a million dollars a year, with the 1954 total of $19.5 million representing an increase of 13 percent over the 1953 figure.

Although sales in 1954 may have been adversely affected by poor crop conditions in the Prairie Provinces, it seems reasonable to assume that sales will continue to advance steadily. An industry estimate

Table 5.—*Sales of Pest-Control Products by Canadian Registrants, 1953–54*

[Quantity in thousands of pounds, unless otherwise specified; value in thousands of Canadian dollars]

Commodity	1953		1954	
	Quantity	Value	Quantity	Value
Agricultural dusts and sprays:				
Aldrin	n. a.	81	n. a.	381
Arsenicals:				
2% arsenical dust (without copper)	4, 880	215	4, 998	246
Calcium arsenate	609	63	865	78
Lead arsenate	1, 114	284	1, 268	311
Paris green	48	22	74	36
BHC (except lindane)	89	13	112	19
Bordeaux mixture, dry	86	19	86	17
Chlordane dusts and powders	314	44	181	36
Copper compounds (fixed copper)	2, 755	484	3, 473	473
Copper compounds, other	84	39	36	55
Copper-lime dusts	195	22	298	27
Copper sulfate	2, 718	294	2, 478	257
DDT:				
Dusts	2, 333	187	2, 780	221
50% wettable powder	1, 200	327	1, 548	398
25% emulsifiable solutions	[1] 58	162	[1] 46	126
Dieldrin dusts and powders	4	7	3	7
Dinitro compounds	37	16	25	8
Dithiocarbamate fungicides	2, 043	473	899	307
Fungicides, other than dithiocarbamates and excluding seed treatments	1, 149	383	1, 010	614
Lime sulfur	[1] 427	105	[1] 468	134
Lindane (wettable powders)	62	139	112	270
Malathion dusts and powders	n. a.	18	363	140
Methoxychlor	42	30	40	28
Mineral oils	[1] 152	56	[1] 176	65
Nicotine preparations, other than sulfate	21	11	15	9
Nicotine sulfate	80	92	73	92
Parathion wettable powders	225	127	210	103
Rotenone dusts (not more than 1% rotenone)	536	149	575	139
Seed treatments	n. a.	1, 808	n. a.	1, 902
Soil fumigants	24	14	53	16
Sulfur dusts	2, 600	247	2, 918	260
TDE or DDD	n. a.	24	n. a.	58
TEPP and HETP	n. a.	22	n. a.	11
Toxaphene emulsions	n. a.	3	n. a.	23
Zinc compounds	79	9	157	19
Other agricultural dusts and sprays	n. a.	336	n. a.	509
Total, agricultural dusts and sprays	n. a.	6, 327	n. a.	7, 395
Livestock treatments:				
Animal insect powders (except warble powders and washes	226	71	311	65
Barn sprays for residual effect	[1] 56	128	[1] 62	138
Livestock sprays	[1] 131	214	[1] 145	247
Warble powders and washes	187	83	201	88
Wormers	n. a.	983	n. a.	2, 044
Other livestock treatments	n. a.	108	n. a.	178
Total, livestock treatments	n. a.	1, 587	n. a.	2, 760

See footnotes at end of table.

Table 5.—*Sales of Pest-Control Products by Canadian Registrants, 1953–54*—Continued

[Quantity in thousands of pounds, unless otherwise specified; value in thousands of Canadian dollars]

Commodity	1953		1954	
	Quantity	Value	Quantity	Value
Herbicides:				
Dinitros	148	37	43	60
MCP	29	48	60	106
TCA	136	56	146	83
2,4–D formulations	n. a.	3, 216	n. a.	3, 420
2,4,5–T formulations	n. a.	76	n. a.	93
2,4–D-2,4,5–T mixtures	n. a.	505	n. a.	343
Other herbicides	n. a.	1, 260	n. a.	616
Total, herbicides	n. a.	5, 198	n. a.	4, 721
Household and industrial insecticides:				
Aerosols (number of units)	1,193,078	848	1,269,708	892
Fumigants (excluding soil fumigants):				
Naphthalene	1, 062	135	1, 172	110
Paradichlorobenzene	2, 254	1, 060	3, 715	1, 407
Other	n. a.	164	n. a.	179
Lindane vaporizers (number of units)	87, 173	209	72, 756	141
Powders and dusts	n. a.	246	n. a.	214
Repellents (mosquito and fly)	n. a.	172	n. a.	318
Sprays:				
With DDT	[1] 150	395	[1] 128	367
Without DDT	[1] 97	438	[1] 97	440
Other household and industrial insecticides	n. a.	129	n. a.	165
Total, household and industrial insecticides	n. a.	3, 795	n. a.	4, 234
Rodenticides:				
Warfarin and Pival type	271	177	446	251
Other	n. a.	137	n. a.	96
Total, rodenticides	n. a.	314	n. a.	347
Grand total	n. a.	17, 220	n. a.	19, 457

n. a. Not available.
[1] Thousands of Imperial gallons.

Source: Dominion Bureau of Statistics, Ottawa.

places foreseeable annual Canadian demand for pest-control products of all types at $40 million by 1960.

A list of pesticides and toxic ingredients used in Canada is on file in the Chemical and Rubber Division, as well as a list of the principal Canadian, United States, and British firms which formulate pest-control products in Canada.

Foreign Trade

Statistics on Canadian imports of pesticides in 1954 (see table 6) show that about 90 percent of imported pesticides was from the United

States, followed in importance by the United Kingdom, Germany, other Western European countries, and Japan. Finished products were almost entirely from the United States.

Poundwise, Canada is the second largest world market for United States pesticides (exceeded only by Mexico in recent years). Exports to Canada include all of the 14 categories under which United States export statistics are compiled on pesticides. Major exports usually consist of DDT, weedkillers, miscellaneous agricultural insecticides and related materials, household and industrial insecticides, and household and industrial disinfectants.

Table 6.—*Canadian Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (Canadian dollars)
Weedkilling preparations:		
Germany	n. a.	6, 024
United Kingdom	n. a.	85, 500
United States	n. a.	2, 535, 576
Total	n. a.	2, 627, 100
Nicotine and salts:		
United States	84, 538	83, 676
Other countries	8, 552	6, 571
Total	93, 090	90, 247
Chloropicrin insecticides, total	n. a.	115, 171
Sprays in packages not over 3 pounds:		
United Kingdom	n. a.	66, 418
United States	n. a.	305, 147
Other countries	n. a.	493
Total	n. a.	372, 058
Disinfectants, dips and sprays:		
Germany	n. a.	292, 108
United Kingdom	n. a.	680, 607
United States	n. a.	6, 054, 011
Other countries	n. a.	81, 596
Total	n. a.	7, 108, 322
Paris green (all from U. S.), total	93, 300	19, 384
Copper sulfate:		
United Kingdom	1, 976, 264	180, 196
United States	149, 048	26, 294
Total	2, 125, 312	206, 490
Lead arsenate (all from U. S.), total	98, 168	16, 447
Calcium arsenate (all from U. S.), total	110, 000	6, 050
Grand total	n. a.	10, 561, 269

n. a. Not available.

Source: Canadian official trade statistics.

According to official trade statistics, Canadian exports of pest-control products are of little significance and are restricted largely to agricultural dusts and sprays and herbicides. In 1954, the only exports reported were "dips, sprays and insecticides," with $148,000 to Brazil, $22,231 to the United States, and $13,626 to all other countries. Canada is a minor producer of toxic ingredients for pest-control products, but immediate export potentialities do not seem significant in view of heavy competition in world markets.

Equipment

Adequate spraying and dusting equipment is available in Canada. Value of Canadian production (sales) of such equipment in 1951 was $1,276,792, in 1952 dropped to $1,106,086, but in 1953 rose to $1,901,608. In those same years imports of spraying and dusting equipment were valued at $1,618,772, $1,520,152, and $2,178,072, respectively. (See table 7 for a breakdown as to types of spraying and dusting equipment sold in Canada in 1953.)

Marketing and Distribution

United States pest-control products are competitive in price and quality with those of Canadian and overseas manufacture. In fact, the availability of United States pesticides at low prices has forced down Canadian prices, especially for DDT and 2,4–D. Lindane and paradichlorobenzene are quoted at slightly lower prices by European producers. Nevertheless, in general, United States products are

Table 7.—*Canadian Sales of Spraying and Dusting Equipment, 1953*

Type	Number of units	Value (Canadian dollars)
Sprayers:		
Hand, pack, sack, barrel and wheelbarrow	54, 711	159, 573
Weed (low-volume, low-pressure):		
Tractor-mounted	3, 222	569, 092
Tractor-drawn	1, 252	150, 376
Orchard, high-pressure:		
Under 15 gallons	192	96, 217
15 gallons and over	475	302, 027
Concentrate sprayers and attachments	242	321, 588
Other sprayers	1, 519	143, 186
Dusters:		
Hand	1, 465	10, 500
Weed	343	89, 020
Other	144	42, 089
Total value		1, 901, 608

Source: Dominion Bureau of Statistics, Ottawa.

preferred for quality, flexibility of supply, low price, lower freight and handling charges, and standardization in method of formulation.

Terms of sale are similar to those in the United States—net 30 days or 1 to 2 percent for payment within 10 days, with letters of credit, sight drafts, and other credit instruments in common use. There are few shipments on consignment basis.

Channels of distribution are those familiar to the United States. Toxic ingredients may be sold to Canadian formulators; exclusive agents may be appointed to sell on a national or regional basis; or a Canadian branch company may be established to act as formulator and/or distributor.

As advertising media, Canadian traders recommend rural magazines and newspapers; farm, trade, and technical journals of either United States or Canadian publication; direct mail; radio; and television. The Canadian industry relies considerably on direct sales contacts, especially in the case of toxic ingredients used by formulators. Advertising costs in some instances are shared by the producer and his sales agent. Some manufacturers offer special discounts to their agents and representatives to assist in absorbing the cost of advertising and promotion.

Government Decrees and Regulations

The Canadian Pest Control Products Act and pest control products regulations dated December 2, 1954, govern pesticide registration, labeling, and packaging, and provide for government inspection of quality. (A copy of this act and regulations is on file in the Chemical and Rubber Division.)

Prospective Developments and Trends

The growing Canadian market for pesticides, and the apparent reluctance of domestic capital to underwrite research, manufacture, and marketing of new products, opens the field for United States capital and technical knowledge. Not only is there opportunity for increased use of pesticides, but also for improvement in their effectiveness. United States capital could probably be best employed in the establishment of Canadian branch plants for formulating pest-control products, using United States facilities for production of toxic ingredients.

To maintain or improve the present competitive position of United States pesticides in the Canadian market, it is suggested that exporters pay increased attention to promotion and marketing, give greater care to selection of agents and distributors, concentrate on specialized products for specific purposes, and, finally, devote more research and testing

to the development of pesticides especially adapted to Canadian requirements.

COSTA RICA

(Based on report by F. Pena, U. S. Embassy, San Jose)

Production

Pesticide materials are not produced in Costa Rica, but there is local compounding and packaging of imported toxic ingredients. The United States press reported in August 1955 that Quimicas Agricolas Centro-Americanas, Ltda (Quimagra), had opened a new formulating plant at San Antonio De Belen. The unit will produce 70 to 150 formulations from imported toxic ingredients and hopes to sell them throughout Central America. United States engineers assisted in setting up the facilities. No government subsidies are offered formulators, but the industry is protected by import duties from competition of imported finished products.

Consumption

Data on consumption of pesticides are not available, but trade and government sources estimate consumption at around 11,700 metric tons a year. Approximately 94 percent of total use consists of copper sulfate, needed for the manufacture of bordeaux mixture, which is consumed principally by fruit companies in control of sigatoka disease on banana plantations. Lime for the bordeaux mixture also is imported. Chlordane and DDT are the other principal pesticides consumed. Toxaphene, methoxychlor, pyrethrum, BHC, lindane, nicotine, and rotenone are used in minor quantities.

Excluding artificial limitations such as exchange and tariffs, and taking into consideration the planned intensification and development of agriculture (principally cacao and coffee), trade and official sources predict that annual consumption by 1960 may reach 19,000 or 20,000 metric tons.

Foreign Trade

According to official trade statistics, 1953 imports of copper sulfate into Costa Rica totaled 24,185,370 pounds, valued at $2,845,992, and insecticides, fungicides, and disinfectants amounted to 1,785,845 pounds, with a value of $412,542.

Before 1950 the United States was the only supplier of copper sulfate to Costa Rica, but in more recent years United States participation has declined and in 1953 accounted for only 26 percent of total volume. Principal competing countries are the United Kingdom

and Belgium. Other pesticide imports originate largely in the United States.

Equipment

Supplies of spraying and dusting equipment are adequate. Manual sprayers and dusters are chiefly in demand and motor-driven equipment is not customarily stocked in important quantities. The United States supplies most of this equipment.

Marketing and Distribution

Despite increased European competition, a marked preference for United States pesticides prevails in trade and consumer circles. European firms, particularly German, have made some gains in the market by sending technical experts (including entomologists) to Costa Rica to give free advice to farmers.

Current terms of sale by both United States and European exporters are 30-day sight drafts to importers of good commercial standing. Customary channels of distribution are local exclusive distributors and selling agents, those believed to be most effective.

According to trade sources, the most effective advertising medium is short radio talks frequently repeated during the day. Advertising in two local monthly agricultural reviews is also believed effective. Periodic visits of special representatives to assist and counsel local distributors is a method practiced by European exporters.

Government Decrees and Regulations

Law No. 11 of August 24, 1954, published in *La Gaceta* of September 14, 1954, effective November 14, 1954, is the only regulation affecting importation and manufacture of pesticides in Costa Rica. This law requires importers and manufacturers of pesticides to apply for registration of their products to the Direccion General de Agriculture y Ganaderia, a dependency of the Ministry of Agriculture and Industries, which issues necessary permits for importation and sale of pest-control products. The application for registration must be made according to a questionnaire form which appears in the text of the law (copy of this law is on file in the Chemical and Rubber Division).

The law prohibits importation of pesticides in used bags.

Foreign exchange for importation of pest-control products and spraying and dusting equipment is granted by law at the official rate of 5.67 colones per United States dollar, compared to the current free rate of 6.65 colones. Local commercial banks comprising the national banking system grant credit facilities to farmers for importation of pest-control products and equipment.

Prospective Developments and Trends

Considering the relatively small domestic consumption, local manufacture of pest-control products (aside from compounding and packaging) does not seem justified, as it could not compete with similar imported products, even assuming tariff protection.

Future prospects for United States pesticides to increase their share of this market may be rated as good (except possibly with regard to copper sulfate), as there is a marked preference for these products.

Intensification of advertising, particularly by radio and in local agricultural magazines; frequent visits of Spanish-speaking traveling representatives with experience in Latin American markets; and assignment of technical experts for free advice and consultation are recommended.

CUBA

(Based on report by F. D. Leatherman, U. S. Embassy, Habana)

Production

Basic pesticides are not manufactured in Cuba. There are about 30 importers and wholesale distributors of pesticides for agricultural purposes, 4 of which are compounders and/or packagers. Toxic ingredients are imported. Compounding and packaging of household insecticides is done by an unknown number of small houses employing no more than 1 or 2 persons, but these operations are not significant in the Cuban industry. A recent survey of Habana homes indicated that 32 brands of household insecticides were being used.

Limited consumption, lack of raw materials, adequate facilities for importing, and easy access to the vast United States market are the principal factors affecting growth of the Cuban pesticide industry.

Consumption

See table 8 for estimates (by Cuban distributors) of 1955 consumption of pesticides in Cuba. Although it is believed that pesticides consumed are 99 percent of United States origin, it is not possible to correlate these statistics on consumption with United States export statistics of pesticides shipped to Cuba.

Both official and trade sources agree that Cuba's consumption of pesticides for agriculture has been increasing at a rate of about 5 percent a year since 1950, and may be expected to continue this trend. Application of weedkillers and the newer insecticides on sugar plantations has shown significant increases in recent years. Improvement in economic conditions of the island and intensification of farmer education would raise this rate of increase.

Table 8.—*Estimated Consumption of Pesticides in Cuba, 1955*

[In pounds of toxic ingredient of United States manufacture, unless otherwise noted]

Commodity	Quantity	Commodity	Quantity
Aldrin	7, 000	Gammexane [1]	36, 000
BHC	13, 200	Lead arsenate	135, 000
Calcium arsenate	150, 000	Lindane	11, 200
Captan	27, 500	Nabam (liquid)	80, 000
Carbonates	30, 000	Nicotine sulfate	20, 000
Chlordane	36, 000	Parathion	33, 000
Copper sulfate	350, 000	Sulfur	475, 000
Cuprous oxide [1]	20, 000	Toxaphene	80, 000
DDT:		Weedkillers	700, 000
25 percent emulsion	28, 000	Zinc sulfate	14, 400
50 percent dust	35, 000	Zineb	97, 500
50 percent wettable	150, 000	Ziram	7, 600
Dilan [1]	7, 200	Other	12, 900

[1] From the United Kingdom.

Source: Cuban trade estimates.

Consumption of pesticicides by public health agencies and householders has decreased slightly in the past 3 years owing to the economic recession caused by the world surplus of Cuba's major crop, sugar. Estimated present value of consumption of products for these purposes is $800,000 a year.

Many new products are proving popular in Cuba; for instance, use of copper sulfate is declining in favor of organic fungicides.

Foreign Trade

Table 9 shows 1953 statistics on Cuban imports of pesticides, practically all of which were supplied by the United States. Agricultural pesticides of excellent quality have been offered by the United Kingdom, Germany, Belgium, and France at terms and prices more favorable than those of the United States. In the past, these products have not always been adaptable to Cuban spraying and dusting equipment, which is all of United States manufacture. However, they are now ground to a degree that permits their use in

Table 9.—*Imports of Pesticides into Cuba, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Insecticides for agriculture:		
Canada	32, 097	3, 827
United Kingdom	114, 763	31, 000
United States	3, 808, 629	791, 467
All other countries	25, 264	4, 125
Total	3, 980, 753	830, 419

Source: Cuban official trade statistics.

available equipment, and it is reported that Cuban mixers are considering purchase of some requirements from European countries.

There appears to be no likelihood of European products displacing United States household insecticides in the Cuban market; United States products are too competitive and trade names are too well established.

Export market potentials are considered nonexistent in Cuba because the possibility of manufacturing pesticides or importing for reexport are extremely remote.

Equipment

Adequate spraying and dusting equipment is available or easily obtainable from the United States. Use of the finest and most modern United States equipment is limited only by the ability of potential users to buy, a factor considered inconsequential in view of the technical assistance offered farmers by the Cuban Ministry of Agriculture, the financial assistance given by the government's Agricultural and Industrial Development Bank, and the long-term credit terms of sellers of United States equipment.

Marketing and Distribution

United States pesticides are extremely popular, but in the past year price differentials between United States and European products have been noticeable. Distances and time required for European products to reach Cuba, and the fact that those products have not until now been ground for dispensing by equipment used in Cuba, so far have prevented noticeable competition. However, present indications are that substantial Cuban orders may be placed in the United Kingdom and Germany.

Terms of sale for United States pesticides are usually letter of credit or payment against sight draft. Some United States firms allow 90 days' credit. European companies almost without exception offer 90 to 100 days or better.

Channels for distribution of pesticides are subsidiaries of United States manufacturers, local agents or representatives of United States companies, and importer-wholesalers. Local government agencies usually do not import direct, and neither the World Health Organization nor the International Cooperation Administration (formerly Foreign Operations Administration) distributes pesticides in Cuba.

All trade sources consulted agreed that United States advertising is deficient in that it is not printed in Spanish. Often United States manufacturers send technical representatives to Cuba who are unable to speak Spanish and can neither explain nor demonstrate their products efficiently in the field without the aid of interpreters.

Germany, in particular, is making big efforts to take advantage of this shortcoming.

The majority of household insecticides are packaged in the United States but are all labeled in Spanish, and advertising media used for these products appear to be efficient. The reputation of a product in the United States is not an effective aid to its sale in Cuba, where each product sells in direct proportion to the time, effort, and money spent in promotion.

Government Decrees and Regulations

No Cuban legislation specifically governs pest-control products. Pesticides for agricultural use are admitted duty-free by law. A resolution on labeling requirements for insecticides and fungicides has been drafted but has not yet become law.

Prospective Developments and Trends

Cuba's limited market and its proximity to the United States, together with its lack of raw materials, would seem to eliminate all opportunity for investment of United States capital and technical knowledge in the manufacture of pest-control products in the island.

Indications are that United States products will continue to supply most of the market. However, advertising exclusively in Spanish and extension of more liberal credit terms probably would increase sales, and also would provide greater protection against the possibility of losing a portion of the Cuban market to European products.

DOMINICAN REPUBLIC

(Based on report by W. W. Woodbury, U. S. Embassy, Ciudad Trujillo)

Production and Consumption

Pesticides are not produced in the Dominican Republic. Reported estimated consumption is 8 to 10 tons per year. (See "Foreign Trade.")

Foreign Trade

Data on imports of pesticides into the Dominican Republic are not available. United States exports of these products to that country rose from 820,000 pounds ($115,000) in 1953 to 3,381,000 pounds ($380,000) in 1955. Principal categories of 1955 exports were: DDT

25 percent and over; sulfur formulations 20 percent and over; miscellaneous agricultural insecticides and related materials; household and industrial insecticides; and household and industrial disinfectants.

Germany and Belgium are reported to be the principal competitors of the United States in the pesticide field.

Equipment

Lack of adequate spraying and dusting equipment is a major limiting factor in usage of pesticides. Point IV technicians are urging stores in the interior to carry larger stocks of hand sprayers and dusters.

Marketing and Distribution

Terms of sale are direct purchase. In the past, local agents of United States firms have accepted only orders for future delivery. The International Cooperation Administration mission is encouraging United States manufacturers to obtain distributors who will keep an adequate supply of pesticides on hand for farmers whose interest is aroused by demonstrations.

Daily newspapers, which are widely circulated, appear to be the only medium for advertising of pesticides. United States pesticides are well known but generally are higher in price than those of European countries.

Government Decrees and Regulations

There is no special legislation or regulations affecting production and distribution of pest-control products. Pesticides are exempt from normal tariff duties, but other fees levied on an ad valorem basis amount to 23 percent.

Prospective Developments and Trends

There appears to be little opportunity for investment of United States capital and technical knowledge in the local manufacture of pest-control products.

The United States has an advantageous position in the market because of its proximity, a preference for its products, and the fact that most of the knowledge in use of pesticides has been obtained from Point IV technicians who are naturally more familiar with United States products and sources of supply. This situation should continue unless there are substantial price differentials between United States and European and Japanese products.

GUATEMALA

(Based on report of C. B. McKnight, U. S. Embassy, Guatemala)

Production and Consumption

No pest-control products are manufactured in Guatemala; all requirements are met by imports. Consumption of pesticides is approximately equal to imports (see "Foreign Trade"). Practically all use is agricultural, only negligible amounts being consumed by public health services and in households. The use of pest-control products is virtually unknown by most of the large Indian population.

Foreign Trade

Pest-control products are imported under basket classifications, as given in table 10. There are no exports of pesticides from Guatemala.

Equipment

Spraying and dusting equipment is in adequate supply. Some power sprayers are used and considerable dusting is done from planes, particularly on cotton plantations.

Table 10.—*Imports of Pesticides into Guatemala, 1952–53*

[Quantity in pounds; value in U. S. dollars]

Commodity classification	1952		1953	
	Quantity	Value	Quantity	Value
Sulfates and copper carbonates; prepared mixtures of mercury, etc., destined for agricultural use	15, 538, 800	$1, 700, 370	16, 382, 500	$1, 551, 132
Calcium arsenate, paris green, lead arsenate, sodium arsenate, white arsenic, calcium cyanide, sodium fluosilicate, etc.	2, 740, 900	374, 365	3, 250, 000	337, 701
Insecticides for domestic use and poisons for destructive animals	1, 524, 800	184, 264	585, 250	99, 709
Other, and not specified	319, 000	91, 411	304, 200	91, 631
Total	20, 141, 500	2, 350, 410	20, 521, 950	2, 080, 173

Source: Guatemalan official trade statistics.

Marketing and Distribution

The United States is close to Guatemala physically and tradewise and United States pesticides have had no serious competition. However, suppliers should be on the alert for a growth in European competition.

Pesticides are sold through local agents of foreign manufacturers, usually by outright purchase. Distribution is through regular commercial channels. Government distribution is by the Production Development Institute, the Ministry of Agriculture, and the Ministry of Health in cooperation with the Pan American Sanitary Bureau.

Foreign manufacturers usually advertise in United States publications which are distributed in Latin America. Importers do a small amount of advertising in local newspapers, and occasionally conduct direct-mail campaigns as well as publish informative bulletins. All advertising should be in Spanish. Guatemalan importers are anxious to obtain informative and descriptive literature for distribution to potential consumers.

Government Decrees and Regulations

There are no special decrees or regulations governing importation, sale, and use of pest-control products.

Prospective Developments and Trends

There is no indication that pest-control products will be manufactured in Guatemala. The United States at present has a large portion of the Guatemalan pesticide market, but sales are not likely to expand greatly until a larger percentage of the Indian population becomes aware of the need for pesticides through educational and advertising campaigns.

HAITI

(Based on report by R. C. Heater, U. S. Embassy, Port-au-Prince)

Production and Consumption

No pesticides are manufactured in Haiti. It is estimated that 600 gallons of toxic ingredients are consumed annually—360 gallons of DDT, and 240 gallons of chlorodane, pyrethrum, etc. Based on normal conditions, usage by 1960 should be 1,000 gallons a year.

Foreign Trade

Official statistics on imports of pesticides are not available. It is estimated that imports in 1954 were about 15 percent above those in 1952. However, United States exports of pesticides to Haiti dropped from 335,000 pounds ($116,000) in 1953 to 81,000 pounds ($17,000) in 1955.

Equipment

Most pesticides are for household use. Aerosol bombs and standard fly spray guns employed for this purpose are freely available in the Haitian market.

Marketing and Distribution

United States brands furnish about 75 percent of the market, and large oil companies are the principal suppliers. All sales are on a sight-draft basis. German firms competing for the Haitian market can be expected to give credit terms. Local agents are the best channels of distribution. Sales volume is too small to warrant an elaborate distribution system.

Newspapers are the best advertising medium.

Government Decrees and Regulations

There is no government legislation which affects production or distribution of pesticides.

Prospective Developments and Trends

United States products already have the major portion of the market, which is on the decline. Most farms are small, 3–5 acres being common, and annual income seldom averages over $60 to $70. Hence the farmer is a very limited market for pesticides or application equipment. Furthermore, the traditional attitude of the Haitian grower has been to discontinue a crop when it becomes pest ridden and substitute another. For instance, the boll weevil has been on the increase since 1938 and each year more and more farmers switch from cotton to other crops. The concept of fighting agricultural pests has not become established.

The average city dweller earns about $1 a day and thus also offers limited market possibilities for household insecticides. The market for pesticides, therefore, appears to be limited to Haitians in the upper-income group and foreigners, a total of probably 50,000 persons.

HONDURAS

(Based on report by N. K. Warner, U. S. Embassy, Tegucigalpa)

Production and Consumption

Pesticides are not produced in Honduras. Large quantities of bordeaux mixture (copper sulfate and lime) are used annually by the banana-growing companies on the north coast. Practically no

herbicides are used, but insecticide imports have been constantly increasing in the past 4 years and it is possible that consumption in the next 5 years may increase by as much as 200 to 300 percent over present levels.

Foreign Trade

See table 11 for imports of pesticides into Honduras in recent years. The United States is the principal supplier, and there is no indication that this position will be challenged in the foreseeable future, although the United Kingdom and Belgium supplied important quantities of copper sulfate in 1952 and 1953.

Equipment

Small farmers use hand-operated spraying and dusting equipment which may be purchased from regular farm equipment outlets, from the National Development Bank's equipment and implement stores, or from extension agencies operated by Inter-American Cooperative Agriculture Service. Some ground equipment is used for applying insecticides to cotton; airplane dusting is not practiced. Specially designed equipment is employed by the banana-growing companies for applying bordeaux mixture.

Marketing and Distribution

Trade sources estimate that from 60 to 70 percent of insecticides used in Honduras are sold by the National Development Bank and by the Inter-American Cooperative Agriculture Service (STICA). Government purchases for sale through STICA or for use in grasshopper-control campaigns are made on basis of bids from local sales agents or directly from manufacturers. Sight-draft payment is usually required by United States exporters.

Little advertising of agricultural pesticides is conducted, most such publicity being directed to the household user of "bugkillers."

Government Decrees and Regulations

So far as can be ascertained there are no laws or regulations affecting production, importation, or distribution of pesticides in Honduras. Such commodities are admitted free of duty, although they are subject to the 8-percent consular fee charged on all imports.

Prospective Trends and Developments

Increasing cotton acreage, resulting in greater use of insecticides, is expected to continue. In 1955, an estimated 335 tons of dust and

Table 11.—*Honduras Imports of Pesticides, for Fiscal Years (July 1–June 30) 1951–54*

[Quantity in pounds; value in U. S. dollars]

Commodity classification and principal countries of origin	1951		1952		1953		1954	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Insecticides of all classes, including "bombs":								
United States	475, 350	$118, 569	842, 375	$214, 044	1, 044, 425	$197, 648	1, 415, 600	$185, 549
Other	13, 470	1, 710	45, 975	3, 584	243, 195	8, 240	69, 060	12, 899
Total	488, 850	120, 279	888, 350	217, 628	1, 287, 620	215, 888	1, 484, 660	198, 448
Fungicides, total	n. a.	n. a.	n. a.	n. a.	496	39	140	53
Copper sulfate:								
Belgium	----------	----------	n. a.	795, 000	n. a.	442, 000	----------	----------
Panama	----------	----------	n. a.	220, 000	----------	----------	----------	----------
United Kingdom	n. a.	345, 000	n. a.	398, 000	n. a.	456, 000	----------	----------
United States	n. a.	1, 447, 000	n. a.	1, 392, 000	n. a.	2, 190, 000	22, 365, 000	2, 112, 000
Total	25, 040, 855	$1,792,000	27, 298, 125	$2,805,000	20, 653, 845	$3,088,000	22, 365, 000	$2, 112, 000

n. a. Not available.

Source: Honduran official trade statistics.

20,000 gallons of liquid was used on cotton alone. About 150 tons of insecticides have been used annually in the government-sponsored grasshopper-control campaigns, which are expected to continue.

The National Development Bank is undertaking a program of grain storage under which a network of warehouses will be built in the next 2 or 3 years. Bank plans to fumigate grain placed in storage should result in an important increase in demand for fumigants. At present, methyl bromide is used for this purpose.

In addition to expansion in cotton planting, the grain storage program, and the antigrasshopper campaigns, an increasingly important factor in the future trend of pesticide consumption is the effort of the 16 agriculture extension agencies to teach farmers how to use pesticides to improve crop production.

MEXICO

(Based on report by R. G. Glover, U. S. Embassy, Mexico City)

Production

Mexico, rapidly becoming conscious of the need to combat pests of all kinds, has developed in recent years a sizable formulating industry. Official statistics show that in 1950, 30 manufacturers (compounding and packaging), with a total investment of approximately $6 million, produced finished pesticides worth $4,825,000. Substantial growth has since taken place in the industry but later statistics are not available. The Camera Nacional de La Industria de Transformación, to which all pesticides formulators and distributors belong, states that there are 33 firms currently engaged in the formulating and distribution of pest-control products. About 25 concerns formulate only products for control of agricultural pests, and 3 firms manufacture and distribute household insecticides on a national basis. The remaining firms are small and confine their activities largely to distribution in local communities.

According to a report received from the U. S. Embassy, Mexico City, dated July 15, 1955, the greatly stepped-up use of insecticides is illustrated by the following developments in the second quarter of 1955: "A United States firm announced plans to produce in Mexico small aircraft suitable for spraying; the Ministry of Communications advertised for experienced pilots to fly crop-dusting planes in the cotton-growing areas; a United States company formed a new insecticide firm in northern Mexico; the Nacional Financiera let it be known that it was studying the establishment of a multi-million dollar insecticide plant in the northern agricultural zone."

In the absence of official data, it is estimated by the trade that pesticides were formulated in the following amounts in 1953:

Type of use		*Metric tons*
Agriculture, total		73, 450
Cotton	67, 000	
Vegetables, cantaloupes, watermelons, corn, grasses, flowers, etc	5, 600	
Fungicides and weedkillers	850	
Household		3, 100
Public health		800
All other		250
Total		77, 600

Domestic availability of raw materials in sufficient quantity to meet requirements for manufacture of pesticides is limited to sulfur, calcium arsenate, lead, and kerosene. All other ingredients are imported, principally from the United States. Insofar as is known, all inert materials also are imported from the United States. Since the devaluation of the peso, formulators have redoubled their efforts to locate satisfactory domestic fillers, but have met with little success. In cotton dusting the inert ingredient is very important and, until such time as a satisfactory filler is found domestically, the United States probably will continue to supply Mexico's total requirements.

Consumption

Data on consumption of individual pesticides are not available and can be approximated only by adding local production and imports. The result indicates that total consumption in 1953 was around 95,376 metric tons. Protection of agricultural crops consumed by far the greater proportion of this amount, but a breakdown among agriculture, public health, and household use is not possible.

It is reasonable to suppose that, with the urgent necessity of Mexico to increase its food supply, consumption of pesticides for agricultural purposes will double within the next 6 to 8 years. The Mexican Government and individual farmers are well aware of the practical results derived from use of pesticides and no doubt their application on crops other than cotton will show a steady and rapid increase. The government also is beginning to treat stored grain to prevent losses. The use of weedkillers is small but is gaining in popularity. The public health program probably will be expanded and may eventually account for a sizable consumption of insecticides.

Foreign Trade

See table 12 for 1953 statistics on imports of pesticides into Mexico. The pattern of imports is fast changing and there are definite

Table 12.—*Mexican Imports of Pesticides, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
United States	1, 801, 258	188, 292
Other countries	564	214
Total	1, 801, 822	188, 506
Copper arsenate and arsenite for production of insecticides:		
United Kingdom	26, 905	3, 875
United States	40, 547	5, 295
Other countries	75	5
Total	67, 527	9, 175
Strychnine for preparation of insecticides (probably rodenticides):		
United States	84, 538	13, 689
Other countries	166	1, 768
Total	84, 704	15, 457
Nicotine sulfate:		
Netherlands	3, 175	1, 492
United States	39, 030	20, 882
Total	42, 205	22, 374
Insecticides with less than 40% DDT:		
United States	293, 942	33, 350
Other countries	136	60
Total	294, 078	33, 410
Insecticides with 40–70% DDT:		
United States, total	2, 523, 784	429, 084
Insecticides with over 70% DDT:		
Germany	730	161
United States	3, 152, 203	799, 437
Total	3, 152, 9 3	799, 598
Agricultural insecticides, n. e. s.:		
Canada	179, 040	11. 210
Germany	758, 272	311, 149
Netherlands	68, 100	22, 585
United States	26, 545, 746	3, 211, 741
Other countries	50, 787	16, 843
Total	27, 601, 945	3, 573, 528
Chlorobenzene for fumigants:		
United States	2, 388, 558	523, 435
Other countries	9, 350	9, 994
Total	2, 397, 908	533, 429
Other insecticidal preparations, total	550, 000	n. a.
Grand total	36, 516, 906	n. a.

Source: Mexican official trade statistics.

indications that imports of prepared pesticides will steadily diminish. Since May 1953, when the government issued a decree placing pesticides under import control, the Ministry of Economy has denied licenses to finished pesticides which can be domestically formulated (from imported toxic ingredients). According to the trade, it seems likely no more imports of copper sulfate will be authorized. This decree, plus devaluation of the peso, augurs for a rapid growth in the domestic formulating industry. All requirements for technical DDT and BHC have been imported, but the government laboratory is beginning to produce BHC on a modest scale, and a prominent United States company recently surveyed the market possibilities for establishing a DDT plant. One difficulty to be overcome is the present lack of domestic chlorine. A United States firm recently entered into partnership with a Mexican concern which operates a small chlorine plant and it is anticipated that output will increase appreciably in the near future. Certain pesticides for which demand is too small to justify local production will continue to be imported.

To date, Mexico has not attempted to develop foreign markets for formulated pesticides, but with the rapid growth of the formulating industry, exports are probable. Mexico has recently started production of sulfur on a basis which should not only make the country self-sufficient, but provide a substantial quantity for export.

Equipment

There is no lack of adequate spraying and dusting equipment. Most cotton dusting is done by airplanes on a contract basis. Modern methods for application of agricultural insecticides are in general use. For crops where airplane dusting is not especially adaptable, other methods, such as jeeps equipped with tanks and sprayers, are used. As the importance of secondary agricultural crops grows, use of modern spraying equipment should increase.

Marketing and Distribution

Marketing and distribution of pesticides for agricultural purposes are by two distinct methods:

The independent and so-called large farmers, especially in cotton-growing areas, buy insecticides direct from formulators who as a rule extend credit until the crop is harvested. Banks and some cotton-buying firms which finance farmers write into the contract a clause covering the cost of dusting and specify the number of applications and the type and quantity of insecticides to be used.

The other system governs the purchase and use of pesticides by the small communal farmers, sales being financed almost exclusively by the Banco Ejidal (a government bank). Farmers applying to the

Banco for a loan to purchase pesticides receive an order on a certain manufacturer or formulator for a specified amount, which is usually applied by hand methods. Payment is made when the crop is harvested.

It is reported that French and Belgian producers of BHC have been quoting prices under those offered by United States firms, at the same time extending credit up to 30 months. While this is formidable competition, United States insecticides have a splendid reputation and are preferred if prices are in line with those of other foreign sources. European competition is confined principally to BHC and lindane but probably will dominate the market for these items, unless United States concerns are able to meet prices and credit terms.

Principal channels of distribution for imported products, including finished pesticides, are the Mexican formulators. These firms are well informed on market conditions and have their own systems of distribution. The Ministry of Public Health, as a rule, buys direct from foreign manufacturers, but its purchases are small compared with the quantity consumed by the agricultural industry.

Since finished pesticides cannot be imported in substantial quantities, extensive advertising of brand names is not justified unless the United States concern has a branch plant in Mexico. The best advertising media are prominent daily newspapers and trade journals. Some United States-owned companies in Mexico have had considerable success in experiments in the principal agricultural sections to prove effectiveness of their particular products.

Government Decrees and Regulations

Before a pesticide can be offered for sale in Mexico, it must be approved by the Department of Agriculture. The government maintains control over retail prices of pesticides, but manufacturers have registered no serious complaints over the minimum prices fixed.

Prospective Developments and Trends

Many of the principal manufacturers of pesticides in Mexico are branches of United States firms whose products are uniform and well received. As the market grows, the opportunity for other United States companies to establish plants in Mexico should increase accordingly. Since importation of ready-mixed pesticides is limited, the principal means for United States firms to increase their markets in Mexico is by opening branch plants. The Mexican pesticide industry, now in its infancy, should grow rapidly within the next 5 years. It would appear that United States firms should now establish their trade brands so as to increase their markets as the industry develops.

NICARAGUA

(Based on report by J. M. Siero, U. S. Embassy, Managua)

Production

Nicaragua lacks a chemical industry and consequently no pesticide materials are manufactured. Until recent years, all pesticides were imported as finished products; however, a mixing plant has been established and now formulates finished pesticides from imported toxic ingredients, imported diluents, and locally produced kaolinite, which is plentiful and of excellent quality. According to well-informed sources, there is also a possibility of obtaining domestic sulfur in commercial quantities.

It was estimated that the local mixing plant would formulate 3 million pounds of finished pesticides in 1954. A modern mixing plant ordered from the United States in 1954 is expected to increase capacity of the installation to 18 million pounds a year, or about 50 percent of consumption of finished pesticides.

Consumption

Estimated 1954 consumption of toxic ingredients used for preparation of agricultural pesticides is as follows (in pounds):

BHC (14% gamma)	404, 500
DDT (100%)	340, 000
Toxaphene	160, 000
Aldrin (60%)	8, 000
Dieldrin (100%)	5, 300
Parathion (25%)	2, 500
Diluent	420, 000
Sulfur	120, 000
2,4–D (gallons)	1, 800

The Ministry of Public Health in 1954 imported 250,000 pounds of 75 percent wettable DDT for use in its sanitation campaign.

It is estimated that 90 to 95 percent of pesticides consumed is in agriculture, principally for protection of cotton and coffee crops. Most of the remainder is used in public health work.

As an illustration of the tremendous development in agriculture taking place in Nicaragua, in 1953 (April to June), the National Bank of Nicaragua made loans of approximately $7,800,000 for planting 123,500 acres (including 50,700 of cotton), and in the corresponding period of 1954 loaned $16,825,000 for planting 204,400 acres (126,750 of cotton).

Consumption of pesticides recently has doubled every 2 or 3 years. If the upward trend in development of new arable land and cotton planting continues (cotton is the greatest consumer of pesticides),

well-informed sources believe that use of pesticides will quadruple by 1960.

Foreign Trade

See table 13 for statistics on imports of pesticides into Nicaragua in 1954.

The United States supplies from 90 to 95 percent of these imports, but European sources are striving to capture a portion of the market by offering lower prices and up to 180 days credit.

Table 13.—*Nicaraguan Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Insecticides, fungicides, disinfectants, and similar materials:		
Belgium	751, 363	56, 640
Germany (Western)	23, 878	5, 721
Netherlands	72, 414	13, 274
United Kingdom	82, 388	8, 000
United States	12, 525, 429	1, 205, 914
Other countries	8, 761	12, 534
Total	13, 464, 233	1, 302, 083
Copper sulfate, United States, total	29, 835	3, 596

Source: Nicaraguan official trade statistics.

Equipment

Dusting and spraying equipment is in plentiful supply and adequate to perform application in a rapid and effective manner. Most cotton pesticides are applied by aircraft.

Marketing and Distribution

United States pesticides are equal, if not better, in quality than those from European sources, and recently United States suppliers have met the lower prices quoted by European suppliers. However, credit terms from those countries are better than those quoted by United States exporters. One United States firm has arranged to supply a local firm with all necessary toxic ingredients for pesticides for local compounding, and has authorized its agent to meet, upon submission and approval of samples, all foreign offers for equal-quality material.

A serious complaint by Nicaraguan importers and distributors of United States pesticides is the lack of interest shown in advertising. Only a few firms print advertising material in Spanish, and English literature is of little use. Direct mail to prospective clients is most effective.

Government Decrees and Regulations

The present system of imports, established in November 1950, catalogs all merchandise into three groups: Essentials, semiessentials, and nonessentials or luxury items, for which exchange is available at the rates of 7, 8, and 10 cordobas to the dollar, respectively. Pesticides are considered essentials and exchange is available at the rate of 7 cordobas to the dollar.

Executive Decree No. 4, dated January 16, 1954, permits importation in bond of pesticides, provided payment for the merchandise has been agreed upon with the exporter on credit terms of not less than 180 days from date of embarkation. This ruling has greatly facilitated importation of pesticides. It is understood that some United States exporters of pesticides refuse to grant such credit terms.

Prospective Developments and Trends

Opportunities for United States capital investment in the pesticide industry of Nicaragua are limited by the relatively small consumption of these products for crops other than cotton. If prices of cotton should drop, acreage would be reduced and consumption of pesticides would decrease. United States technical knowledge is being used to good advantage by the local formulating plant. United States technicians spend 2 months each year helping the plant's local staff solve any problems which may arise.

PANAMA

Material on file in the Chemical and Rubber Division indicates that Panama has only a small chemical industry and that pesticide requirements are met by imports.

Copper sulfate for control of sigatoka disease on banana plantations is the principal pest-control product used, but in recent years sizable amounts of the new organic pesticides have been consumed. In 1953, the Chiriqui Land Co., the largest agricultural entity, initiated aerial dusting on its banana plantations. However, most bordeaux mixture is still applied by special spray equipment. The Point IV program is active in Panama and should increase demand for insecticides for cattle and crops, particularly cotton.

Import data are not broken down as to commodities or countries of origin. In 1953, imports of insecticides totaled 23,742,229 pounds ($1,342,163), and of disinfectants, 324,801 pounds ($49,104).

EL SALVADOR

(Based on report from R. C. Desmond, U. S. Embassy, San Salvador)

Production

Basic pesticides are not manufactured in El Salvador. However, a mixing plant owned by the Salvadoran Cotton Cooperative formulates cotton dust from imported toxic ingredients. Its output was 1,400,000 pounds in 1952–53, less than capacity. A new company, Agricultural Chemical del Salvador, S. A., San Salvador, began production in the last half of 1955 on a 24-hour, 7-days-a-week basis. Both liquid and powdered insecticides are made from imported toxic ingredients which will cost an estimated $400,000 for the first year's operations. The United States supplies the toxic substance, and a high-quality inert material is available from domestic sources. Small deposits of sulfur exist but have not been exploited.

Consumption

Estimated consumption of important pest-control products in 1953, with percentage used on cotton, are shown in table 14. Consumption for public health purposes and household use is negligible. Almost 90 percent of pesticides consumed are used on cotton acreage, with a small quantity of aldrin, 3-percent BHC, and 5-percent DDT being applied on coffee plantations. The amount used for protection of the coffee crop increases materially when serious outbreaks of the coffee cricket occur. Similarly, consumption of insecticides by the Ministry of Agriculture for control of the migratory locust increases greatly when this pest becomes a serious threat. The only other crops on which significant, although small, quantities of insecticides are used include sugarcane, corn, and possibly rice.

Table 14.—*Estimated Consumption of Principal Pesticides in El Salvador, 1953*

Product	Total consumption (pounds of toxic ingredient)	Percent used in agriculture	Percent used on cotton
BHC	111, 000	100	50
DDT	319, 000	90	85
Aldrin	118, 000	100	95
Parathion	37, 000	100	97
Toxaphene	250, 000	100	90
Chlordane	14, 400	100	35
Dieldrin	1, 000	100	10

Source: Based on data of sales and consumption by the Salvadoran Cotton Cooperative and official agencies, and estimates of consumption by farmers buying directly from dealers.

Salvadoran farmers usually are quick to try new insecticides on an experimental basis and, if they prove satisfactory, expand their use. Aside from this tendency, it appears that consumption of pesticides will not increase substantially in the near future. While use of pesticides for crops other than cotton may increase, experiments by the entomological department of the Centro Nacional de Agronomia (an agency for agricultural investigation which received technical assistance from the United States) have shown that equally good control of cotton insects can be obtained by fewer applications. Hence, cotton growers in all probability will gradually adopt more economical practices. Furthermore, prospects are that the area planted in cotton will not expand substantially, although it may fluctuate from year to year, depending on price and other factors.

Foreign Trade

Since 1952 there has been a significant increase in imports of pesticides from European countries, particularly Germany. In 1954, German prices for parathion and combinations of BHC and DDT were lower than those for United States products.

Import statistics do not give a breakdown of commodities imported nor of countries of origin.

Equipment

The availability of equipment is not a limiting factor in the Salvadoran demand for pesticides. Few small farmers have spraying and dusting equipment, but such equipment is readily obtainable by those who can afford it.

Marketing and Distribution

Distribution of pesticides is almost entirely through local agents. By far the largest single purchaser is the Cotton Cooperative, which accounts for well over half of total sales. The Cooperative, after taking advantage of its large orders to obtain a low price, resells at cost to its members. The Ministry of Agriculture also sells insecticides at cost to small farmers.

United States pesticides are comparable in quality to those offered by European firms, although it is reported that some cotton growers are claiming better results with German products than with United States pesticides. The reason is probably that German products were used for the first time in the 1953–54 season, when weather conditions were particularly favorable and excellent insect control was obtained. European manufacturers usually pack insecticides in 100-pound jute

bags with impermeable paper liners, a practice which has considerable appeal to cotton growers, who later use the bags for their cotton.

European suppliers commonly sell through agents on a consignment basis, as do United States exporters. Most United States exporters require sight drafts, while European suppliers offer more liberal terms of payment.

The most effective form of advertising for pesticides probably is the educational approach, such as distribution of leaflets or pamphlets describing the life cycle of insects and effective means of control. Such materials should be in Spanish and adapted to conditions existing in El Salvador.

Since cotton growers are, and probably will continue to be, by far the most important Salvadoran customers, advertising material might effectively emphasize the fact that the United States is the world's largest producer of cotton and therefore United States firms are most experienced in cotton insect control.

Government Decrees and Regulations

El Salvador has no exchange restrictions. A government decree of March 23, 1954, which imposes control on the importation, distribution, and use of all pesticides, provides that such products cannot be imported and sold without approval of the Ministry of Agriculture. The decree also requires that labels carry in Spanish the name of the manufacturer, the formula, instructions for use, and necessary precautions and antidotes if the product is poisonous. The primary purpose of this decree was to limit the use of phosphatic insecticides which have caused a number of fatalities in recent years. Future imports of such products will probably be permitted only for those purposes for which other insecticides are not effective.

Prospective Developments and Trends

The only opportunities for investment of United States capital in the Salvadoran pesticide industry appear to be in establishment of a plant for processing deposits of diatomaceous earth for use as inert material, or by building a formulating plant.

The Cotton Cooperative purchases almost exclusively United States pesticides, and probably would be reluctant to change since its members know and have confidence in these products. However, a number of farmers have turned to German suppliers in recent years, because many of the most common pesticides are offered at prices below those in the United States.

In order to improve the market position of their products, United States manufacturers should consult with their local agents as to the advisability of intensifying advertising, and also as to the desirability

of modifying packaging along European lines. However, price will be the determining factor.

TRINIDAD AND TOBAGO

(Based on report by K. P. Steins, U. S. Consulate General, Port-of-Spain)

Production

Pesticides are not manufactured in Trinidad but are compounded and packaged locally. Production data are not available. One company imports ingredients in concentrated form and formulates pesticides by addition of domestic powdered limestone or kerosene. A local oil company produces several pesticides, including weed-killers, in liquid form with an oil base consisting of domestic kerosene or gas oil. This company also manufactures a fungicide consisting mainly of imported copper oxychloride mixed with water. A number of local pharmacies compound and sell insecticides composed principally of imported DDT and pyrethrum in a base of methylated spirits and/or kerosene. A few hardware stores and the Department of Agriculture import concentrated chlordane to dilute with water for domestic sale. Perhaps the most common toxic ingredient imported for formulation of pesticides is copper sulfate for bordeaux mixture which is used on the Colony's sugar estates.

Consumption

Consumption statistics are not compiled. Pesticides commonly used in agriculture are BHC, DDT, chlordane, aldrin, dieldrin, calcium cyanide, 2,4-D, and pentachlorophenol. Those consumed in public health work are DDT, aldrin, dieldrin, chlordane, warfarin, and larvacidal oils (for malaria control). Usage of DDT in public health work probably will increase in the next few years. Use of 2,4-D is understood to be standard practice on most sugar estates, but it is not applied elsewhere. Fungicides are little used. Plant diseases which might involve considerable future consumption of fungicides are banana leaf spot and diseases affecting cocoa pods. The Imperial College of Tropical Agriculture is experimenting with the use of copper fungicides for control of cocoa-pod diseases.

Future consumption of agricultural pesticides is difficult to predict. The use of chlorinated hydrocarbon insecticides against sugarcane froghopper will depend on continued efficacy and they may be replaced by other compounds, for instance, phosphatic insecticides. Banana

production is being expanded and serious outbreaks of banana borer weevils might prompt increased use of aldrin. If endrin, now used experimentally, proves efficient in control of rice borers, consumption may be expected to rise rapidly.

Foreign Trade

See table 15 for statistics on 1953 imports of pesticides into Trinidad and Tobago. Imports of DDT, BHC, chlordane, aldrin, and dieldrin are on the increase.

Equipment

On well-organized farms and large estates, equipment is generally adequate, but the lack of cheap, simple, and efficient spraying equipment probably is a limiting factor in the widespread use of pesticides by the peasant farmer. Procurement of such equipment from the United States is limited by currency restrictions. Aerial application of pesticides is not practiced.

Marketing and Distribution

United States pesticides compare well in quality with products from other sources, but in some cases they are more expensive and, of course, involve expenditure of hard currency.

Table 15.—*Imports of Pesticides into Trinidad and Tobago, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Insecticides, fungicides, disinfectants, etc.:		
Hong Kong	54, 700	25, 275
United Kingdom	1, 179, 600	235, 775
United States	45, 600	21, 775
Other countries	15, 700	7, 815
Total	1, 295, 600	492, 610

Source: Official statistics on imports into Trinidad and Tobago.

Pesticides from sources other than the United States are normally obtained by direct purchase. Large companies, such as the sugar estates, usually import pesticides direct from suppliers abroad. Small consumers sometimes import through local agents. The government often obtains public health pesticides through the Crown Agents (government purchasing agents) or from international organizations such as WHO (World Health Organization) or UNICEF (United Nations International Childrens' Emergency Fund).

Government Decrees and Regulations

The Public Health (Yellow Fever) Regulation of 1954 regulates pesticides used for public health purposes.

Prospective Developments and Trends

Because of lack of dollar exchange, Trinidad and Tobago undoubtedly will continue to import a large portion of pesticide requirements from soft-currency countries. However, the Colony is dependent on the United States for many of the newer organic pesticides which evidently are being used in increasing quantities.

South America

Argentina, Brazil, Chile, and Peru manufacture pesticides, including some of the chlorinated hydrocarbons, and considerable formulating of imported toxic ingredients is carried on in several of the republics. Nevertheless, South America remains the second largest market for United States pesticides.

ARGENTINA

(Based on report by V. P. Vaky, U. S. Embassy, Buenos Aires)

Production

BHC is the principal insecticide manufactured in Argentina. Three producers (Electroclor, Cia. Quimica, and Indupa), with a combined annual capacity of about 5,000 metric tons of technical BHC (12–13 percent gamma isomer content), formulate various dusts and concentrates, some of which are sold to the government for locust and grasshopper control. The major portion of lindane produced (Cia. Quimica and Atanor) is consumed for household purposes. Although DDT is not now (1954) produced in Argentina, Atanor has a plant under construction with an estimated capacity of 1,200 metric tons a year, sufficient to meet Argentine requirements.

Cia. Quimica is the sole producer of lead arsenate, and output of 1,500 tons meets domestic needs. Cia. Quimica and Bayer produce nicotine sulfate, consumption of which (mostly for aphid control) is small. Paris green is produced from imported arsenic and copper sulfate by Cia. Quimica and Luis Grassi, with a combined annual capacity of 500 tons. Carbon bisulfide, manufactured by three companies (Duperial, Luis Grassi, and Partenopea), is employed principally as a rodenticide, for ant control, and as a grain fumigant. Copper sulfate production was initiated by Partenopea in 1953, and Electroquimica planned to begin production in 1954; this additional facility will bring output in line with domestic requirements. Methyl bromide, manufactured by Rhodia, is used almost exclusively for fumigation of grain.

In 1953 Argentina produced about a third of its requirements of crude sulfur for all purposes. Several firms manufacture lime sulfur,

dusting sulfur, and sulfur paste for agricultural purposes. Only wettable sulfur is imported for agricultural purposes.

Three petroleum companies which produce spray oils from domestic and imported petroleum also produce petroleum weedkillers for use in carrot weedings and as a general contact herbicide.

In addition to production of pesticides (see table 16), there is widespread compounding and packaging of these commodities from imported ingredients. Several companies compound and package imported 2,4–D and 2,4,5–T acid and esters. Other commodities imported for subsequent packaging and compounding include organic miticides, aldrin, dieldrin, chlordane, and toxaphene. Organic mercuric fungicides also are imported and compounded, principally for use as seed disinfectants. Dithiocarbamate fungicides and copper compounds (other than copper sulfate) are imported and compounded for specialized purposes such as seed disinfectants and for protection of tomatoes, tobacco, and vegetables. Small amounts of imported parathion have been used for spraying fruit and olive trees.

The total amount of compounding and packaging is dependent on availability of exchange for importation of the necessary ingredients. It is estimated that about 5,000 metric tons of these finished products and formulations were marketed in 1953.

Benzene, chlorine, acetic acid, ethyl alcohol, sulfuric acid, and other basic chemicals are domestically available for the manufacture of pesticides. Various diluents, such as clay, talc, kieselgur earth, gypsum, and calcium carbonate are also obtained from local sources, and solvents, such as aliphatic fractions of petroleum and toluol, are locally produced. Containers of all kinds are in adequate supply.

The principal governmental assistance to the pesticide industry is protection from competing imports. For example, to protect the market for locally made BHC, toxaphene imports are permitted only for cattle dips and not for control of cotton insects. Similarly, the government has announced that it will not permit imports of DDT

Table 16.—*Argentine 1953 Production of Principal Pesticides*

[In metric tons, toxic ingredients]

Commodity	Quantity
BHC (12–13 percent gamma isomer)	3, 500
Carbon bisulfide	1, 500
Copper sulfate	300
Lead arsenate	1, 500
Lime sulfur	2, 500
Lindane	18
Methyl bromide	20
Nicotine sulfate	50
Paris green	400
Wettable sulfur and sulfur dusts	1, 300
Petroleum distillates—liters	4, 000, 000
Spray oils—do	5, 000, 000

once domestic production can supply requirements. Aid is sometimes granted for individual projects by exemption from customs duties and deferred exchange payment for machinery imports.

Consumption

Table 17 shows estimated 1953 consumption of major pest-control products in Argentina, estimated percentages used for agriculture, and projection of consumption to 1960.

Future consumption of pesticides will depend largely on the development of manufacture and availability of foreign exchange for necessary imports. The largest outlet is in agriculture, and progress in this field will depend upon increased technical studies of Argentine conditions and efforts of the government and private organizations toward scientific agricultural practices.

BHC (used largely on cotton) and lead arsenate (for control of coddling moth and basketworm in orchards) probably will continue to be the principal insecticides used for some time, since they are domestically produced, largely from local raw materials. Spray oils, domestically produced on a large scale and comparatively cheap, also probably will continue to hold the market for pest control on citrus, olive, and deciduous fruit trees. Consumption trend for lime sulfur is downward; its use as a sheep dip has practically disappeared in favor of BHC, and as a miticide it is being replaced by more effective organic formulations.

For household and public health use, DDT and lindane undoubtedly will continue to be the principal insecticides consumed. With the initiation of DDT production and consequent greater stability in supply and probable lower prices, the market should increase proportionately. Because of its high price, DDT has not been used on cotton. Aldrin and dieldrin have been intensively tested under local conditions and are to be marketed in commercial quantities in 1955. Provided adequate imports are permitted, these products eventually will be popular for grasshopper and ant control. Tests are being conducted on the use of isodrin and endrin under local conditions. Small amounts of parathion have been imported and found to be very effective in controlling scale on olives and mites on deciduous fruit trees. Systemic insecticides are being tried on cotton. BHC is gradually replacing nicotine sulfate for aphid control.

Copper sulfate is the most widely used fungicide. Organomercuric fungicides hold practically the entire market for seed disinfectants. Consumption of these commodities should increase as the practice of disinfecting seeds spreads.

Consumption of hormone-type herbicides, principally 2,4–D, is expected to increase greatly in the next 5 years, chiefly for weed control in grain fields and pastures. Trade sources estimate that at present

only about 2 percent of treatable acreage is controlled with this type of herbicide. There are at least three projects for domestic manufacture of 2,4–D and production is expected to begin in 1955. When domestic supplies are available, consumption of 2,4–D should increase considerably. The use of 2,4,5–T as a brush killer also is expected to grow.

Use of heavy petroleum distillates by railroads for killing weeds has been increasing each year, and this consumption trend is expected to continue upward.

Table 17.—*Argentine Consumption of Major Pesticides*

[In metric tons unless otherwise stated]

Commodity	1953 consumption	Percentage used for agriculture	Estimated consumption 1960 [1]
Aldrin	Experimental	95	300
Allethrin	50	----------	250
Calcium cyanamide and cyanogas	50	45	150
Carbon bisulfide	1, 500	98	3, 000
Chlordane	150	10	200
Copper fungicides (other than copper sulfate)	150	100	300
Copper sulfate	2, 000	100	4, 500
DDT (100 percent)	1, 100	45	3, 500
Dieldrin	Experimental	95	200
Dithiocarbamate fungicides	50	100	200
Lead arsenate	1, 500	100	4, 000
Lime sulfur	2, 500	100	2, 000
Lindane	18	2	30
Methyl bromide	20	100	100
Nicotine sulfate	70	95	100
Organic miticides	20	100	1, 000
Organo-mercuric fungicides	70	100	300
Paris green	400	98	500
Parathion	Experimental	100	300
Petroleum distillates	4, 400	100	13, 000
Pyrethrum flowers	700	----------	900
2, 4–D (40 percent acid)	400	100	8, 000
2, 4, 5–T	20	100	500
Toxaphene	200	100	800
Wettable sulfur and sulfur dust	1, 400	100	2, 500
Spray oils-------liters	5, 000, 000	100	26, 000, 000

[1] This assumption assumes current income levels and excludes artificial limitations such as exchange, tariffs, etc. It also is based, as far as agricultural use is concerned, on 1953 acreage, and is computed on amounts which would be used if applied to all treatable acreage in the doses and rates dictated by sound technical control measures. These figures must therefore be considered as highly theoretical.

Recent investigations on the use of soil sterilants indicate a potentially excellent market provided sufficient imports are permitted. These commodities will be especially useful for rights-of-way, fields, canals, and ditches.

Coal-tar oils, fluorine compounds, and soil fumigants are not in general use. Pyrethrum has been used in substantial quantities for household insecticides, as well as smaller amounts of allethrin. Consumption of these two products should hold steady during the next few years and possibly rise if larger imports are permitted.

Foreign Trade

See table 18 for Argentine imports of pesticides in 1953. United States products enjoy considerable prestige in the Argentine market, and in recent years have accounted for about half of total imports. United States prices have been competitive with those of other suppliers, although in 1954 for the first time some European quotations, on DDT and copper sulfate, for example, were slightly lower than United States prices.

The principal deterrent to purchases of United States pesticides has been shortage of dollars, and the Central Bank has given import permits, wherever feasible, to suppliers in soft-currency countries. Thus the more common pesticides, such as copper sulfate, have been imported from these countries, the highly technical and newer products from the United States.

The desire to conserve foreign exchange also has been responsible for the growing trend toward granting preference in exchange allocations for importation of raw materials or active ingredients rather than finished products. This trend is expected to continue as the government encourages domestic compounding and formulation of pesticides.

In general, purchases of pesticides and raw materials from suppliers other than the United States have been made as direct purchases from the overall barter arrangements established in Argentina's various bilateral trade agreements. Germany, the United Kingdom, France, and the Netherlands are the principal competitors of the

Table 18.—*Argentine Imports of Pesticides, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Insecticides, liquid:		
United Kingdom	287, 160	119, 683
United States	552, 411	171, 235
Total	839, 902	291, 353
Insecticides, in powder form and general:		
Germany (probably Western)	10, 648	85, 532
United Kingdom	115, 071	27, 261
Total	132, 873	115, 924
Other insecticides and parasiticides in extract, liquid, paste, etc.:		
Germany	118, 951	61, 539
Italy	505, 303	234, 723
United Kingdom	961, 717	350, 933
United States	344, 912	90, 645
Total	1, 941, 642	744, 457
Grand total	2, 914, 417	1, 151, 734

Source: Argentine official trade statistics.

United States in the Argentine pesticide market. All pesticides and ingredients are imported at the basic rate of 7.50 pesos to the dollar. Customs duties average 6 percent of the c. i. f. value.

Equipment

The availability of spraying and dusting equipment is not a serious deterrent to pesticide consumption. An estimated 20 firms manufacture such equipment and the supply is increasing. As pesticides become more widely used, manufacture of this machinery is expected to rise proportionately. Estimates of equipment now in use are as follows (units):

Power spray machines	4,500
Hand-operated sprayers on wheels	5,500
Knapsack sprayers	46,000
Dusters	No data

Motor units are used principally for fruit and olive trees and weed control; knapsack sprayers for vineyards, vegetable crops, and tobacco; and dusters for such purposes as control of locusts. There is some movement toward aerial application which has been limited to government control of major pest infestations.

Fumigation of grain is done almost entirely by six contractors, who also do about 15 percent of weed-killing application. While contract spraying is decreasing, due to greater availability of spraying equipment at relatively low prices and liberal credit offered farmers for purchases of such machinery, it probably will continue to be the principal method for applying such products as phosphatic and systemic insecticides, which are extremely toxic to humans.

Marketing and Distribution

An estimated 70 percent of trade in pesticides is by sales from supplier to dealer or retailer to consumer, and about 30 percent by sales direct from the supplier to consumer. Distribution through retail outlets is increasing as the number of specialties marketed by each supplier increases, and direct sales are being limited more and more to purchases by government organizations. Household and garden pesticides are sold through retail stores.

Each manufacturer or seller of pesticides is required by law to staff at least 1 qualified agronomist, and in the case of livestock products, at least 1 qualified veterinarian.

Credit is usually extended for agricultural pesticides, terms varying with the product and the season. Most products are paid for by the consumer at the end of the season. The time varies from about 120 days for BHC dust for cotton to 6 to 8 months for dormant spray oils for use on fruit trees.

There is practically no distribution of pesticides by government agencies. Both the federal and provincial public health departments utilize pesticides for insect and rodent control.

The Ministry of Agriculture undertakes certain pest-control operations. For instance, the Bureau of Acridology is responsible for large-scale locust- and grasshopper-control campaigns, often in cooperation with neighboring countries. This control is usually performed by aerial and land dusting. The Ministry of Agriculture also operates official dips for cattle moving between tick-infested and "clean" areas, and sprays fences and windbreaks along roadsides for basketworm control. Other government entities, such as the railroads, are also important purchasers of pesticides.

Publicity for agricultural specialities usually is in the form of folders, pamphlets, circulars, and manuals describing a product and containing instructions on its use. Advertising is also common in agricultural and livestock magazines, of which there are about 20, as well as in newspapers published in farm areas. This type of publicity usually coincides with the appropriate season for the product in question. In addition, some companies use billboards and posters in rural areas. Household insecticides are advertised principally through newspapers and posters.

As a rule, new products are introduced, promoted, and established by the technical and sales efforts of private suppliers. Scientific research by official organizations is limited by lack of trained personnel and insufficient funds, and consequently the burden of technological research devolves on private concerns. The larger firms run tests for formulations of finished pesticides and their adaptation to local conditions before the product is released for sale. Many of these firms are subsidiaries of foreign companies and are able to utilize basic research already undertaken by their principals.

Government Decrees and Regulations

Imports of pesticides are carefully controlled by the government. The Central Bank periodically announces that it will receive applications for importation of specified products. On the basis of applications received, the Bank allocates exchange among the various applicants, according to exchange availability, the amount of the request, and previous import history. Each application must be accompanied by a certificate from the Ministry of Agriculture or the Ministry of Public Health to the effect that the product is not available locally and is essential to the country's economy or well-being. The Ministries usually require data on the product, its uses, toxicity, etc., before granting this certificate.

All pesticides must be approved by the government before sale in Argentina, those for agricultural use by the Ministry of Agriculture,

and those for household or public health purposes by the Ministry of Public Health. Insecticides used in both agriculture and households require approval from both Ministries. To obtain such approval, detailed information regarding the chemical formula, uses, and previous experiments must be submitted. The usual practice is to issue a temporary permit valid for 2 years following a preliminary examination and laboratory tests. During these 2 years field tests are completed, then a permanent permit is issued. Approvals are granted for the chemical product only and not for brand names.

Sales of pesticides in other than bulk containers, such as drums or barrels, require approval of containers and labels by the Ministry of Commerce, which is usually automatically granted in a few days. Labels must carry a general description of the formula with percentage content and name of the active ingredients.

There is no control of prices or production. From time to time, the Ministry of Commerce requires that manufacturers and importers report output, stocks, and sales of specified products. Such regulations are now in effect for lead arsenate and DDT. This ruling serves to keep a check on items which may be in short supply.

Prospective Developments and Trends

As a result of development of new pesticides not elsewhere available and widespread information on their effectiveness, United States commodities enjoy considerable prestige in Argentina. However, until dollar availability is greater, products manufactured in areas outside the United States probably will continue to be imported from soft-currency areas.

Argentina is desirous of promoting domestic manufacture, compounding, and formulating of pesticides to conserve foreign exchange and to develop local industry. To promote industrial development through foreign capital investment, the government recently passed a foreign investment law providing for profit remittances and capital repatriation. These factors, combined with the high regard for United States technical know-how, offer opportunities for investment of United States capital and technology in manufacture of pesticides in Argentina. Interest in Argentine manufacture of pesticides has recently been shown by British and German firms.

To improve the competitive position of their products, United States firms should take advantage of current advanced technology and research by wide dissemination of technical literature on various products, particularly the newer pesticides. Agriculture offers the largest immediate opportunity for market expansion. Argentine research in adaptation of pesticides to local conditions is limited, hence actual field tests by United States firms and active investigation of local pest-control problems appear advisable. Close cooperation on

technical problems with Argentine Government agencies operating in this field should be established. Sales promotion should also emphasize the improvement in agricultural yields which would result, since this point is of particular interest to the Argentine Government, especially with regard to export crops.

BOLIVIA

(Based on report by M. S. Leggett, U. S. Embassy, La Paz)

Production

Manufacture of pest-control products in Bolivia consists of formulating finished products from imported toxic ingredients. Output during 1953, as reported by the two formulators, was as follows:

"Perplex"—containing DDT and pyrethrum	5,400 liters.
"Lucifer"—containing 3 to 20 percent DDT	5,000 pounds.
"Hormitox"—containing chlordane and DDT.	Production data not available; annual output believed to be less than 5,000 pounds.
"Sarnifuge"—with base of Lexone and DDT	
"Garrapatacida"—with a base of Gammexane.	
"Vermifugo"—with a base of phenothiazine and carbon tetrachloride.	

Domestic raw materials available for manufacture of pesticides include sulfuric acid, ethyl alcohol, sulfur, and copper sulfate, but output of both sulfuric acid and ethyl alcohol is too low to meet requirements. The Servicio Agricola Interamericano (SAI), a part of the U. S. Operations Mission to Bolivia, is studying the possibility of using volcanic ash, which is present in large quantities, as diluent for pesticides.

Consumption

Official consumption data are not available. Imports of pesticides are estimated at from $60,000 to $80,000 a year, of which about 50 percent are products containing DDT; 20 percent, BHC products; 20 percent, 2,4–D and other weedkillers; and 10 percent, other types.

Pest-control products imported into Bolivia by SAI from January 1953 through June 1954 were as follows:

Commodity:		
BHC 10 percent gamma isomer	pounds	27, 600
DDT 50 percent wettable powder	do	11, 500
Methoxychlor 50 percent wettable powder	do	2, 500
Toxaphene 40 percent wettable powder	do	2, 500
Dieldrin 15 percent wettable powder	do	1, 000
Chlordane 40 percent wettable powder	do	9, 000

Commodity—Continued		
Sulfur	pounds	4, 500
Aldrin 25 percent	do	4, 000
Aresan, Semesan, Fermate, Dithane	do	1, 500
Rodent bait, spreader-stickers, etc	do	500
Other insecticides and fungicides	do	3, 000
Weedkillers	gallons	350
Oil emulsions	do	750

Major users of pesticides are the Ministry of Agriculture and Banco Agricola, both government agencies, which are endeavoring to disseminate knowledge of pest-control products and methods of use. SAI and Servicio Cooperative Interamericano de Salud Publica (SCISP) also have similar programs. It is estimated that agriculture accounts for 80 percent of consumption; public health, 15 percent; and household use, about 5 percent.

If satisfactory progress is made in the government's plans for economic diversification, which include a considerable expansion in agriculture in order to cut down Bolivia's current $25 million annual bill for imported foodstuffs, and if the program now being conducted by SAI and other agencies succeeds, consumption of pest-control products might well be multiplied several times by 1960.

Foreign Trade

Only meager import statistics on pesticides are available. It is believed that approximately 70 percent of imports arrive from the United States, 20 percent from Argentina, 8 percent from the United Kingdom, and the remaining 2 percent from other countries.

Campaigns by the Ministry of Agriculture against common vegetable insects (potato and tomato bugs particularly) are believed to have been effective in encouraging greater imports and consumption of insecticides. Imports of locust-control products valued at $15,000 to $20,000 have been made from Argentina, in accordance with a tripartite agreement between Bolivia, Argentina, and Paraguay.

Equipment

There is a serious lack of equipment such as sprayers and dusters. To some extent this situation is being remedied by the importation of these items under the reimbursable-facilities project of the International Cooperation Administration. The Ministry of Agriculture has on hand some 2,000 hand-pump sprayers, a few motor sprayers, and some other equipment, but estimates that it needs an additional 10,000 hand-pump sprayers and about 200 motor sprayers. The tripartite agreement provided for the use of aircraft to combat locusts.

Marketing and Distribution

United States pest-control products are considered the most costly but are the most widely known and are of excellent quality. Terms of sale for pesticides are understood to be direct purchase for cash.

Radio and the press are effective advertising media, and circulars for distribution to potential consumers also should prove useful. The field demonstrations made by SAI, however, are considered to be the most effective promotional activity.

Government Decrees and Regulations

There are no decrees or regulations affecting manufacture and distribution of domestic and imported pest-control products. However, according to standing regulations (Supreme Decree of August 26, 1954), pesticides (paragraph No. 350 of the Bolivian Customs Tariff) are subject to the following duties and fees:

Customs duty of 130 bolivianos (1 boliviano equals ($0.052) per 100 kilograms;
Subsidiary custom duty of 20 percent on the previous duty; plus
One boliviano per gross kilogram; plus
Consular fee of 6 percent ad valorem, calculated on the c. i. f. value of the merchandise; plus
Custom services fee of 1 percent ad valorem, calculated on the c. i. f. value of the merchandise; plus
Gross sales tax of 10 percent ad valorem calculated on the c. i. f. value of the merchandise, plus all other fees and taxes except the additional c. i. f. ad valorem.

All imports are subject to import license issued by the Central Bank of Bolivia. Foreign exchange at the rate of 190 bolivianos to the United States dollar is granted for importation of pest-control products.

Prospective Developments and Trends

The size of the market limits opportunities for investment of United States capital and technical knowledge in Bolivia's pesticide industry.

Only about 2 percent of land is under cultivation and the population of the country is only 4 million, hence Bolivia's imports of pesticides will necessarily be limited. However, demand by farmers for comparatively simple pest-control products which require no special preparation or equipment to apply is greater than the supply, and the Ministry of Agriculture has been obliged to distribute these preparations on a quota basis.

The best means for United States firms to promote sale of their products in Bolivia is to send qualified representatives to make on-the-spot investigations of local conditions. At least 1 United States firm and 1 German firm have already undertaken such a project. The United States enjoys a major share of the market and its relative share

in the future probably will be determined largely by price. If prices can be kept to a minimum and quality up to standard, the United States should continue to enjoy a dominant position in the Bolivian market for pesticides.

BRAZIL

(Based on report by A. M. Hartman, U. S. Embassy, Rio de Janeiro)

Production

Production of pest-control products is comparatively recent in Brazil. Benzene hexachloride (12 percent dry) is produced by Industrias Reunidas F. Martarazzo of Sao Paulo, and Eletro Chloro S. A., and Eletro Quimica Fluminense S. A., both of Rio de Janeiro, with a combined output estimated at 7,500 metric tons a year. Copper sulfate is produced by 8 companies whose total annual output is about 1,500 tons, against total requirements of 4,000 tons. Companhia Quimica Rhodia Brazileira, Sao Paulo, manufactures parathion; capacity is about 100 tons a year (100 percent basis), which evidently meets present demand.

Rotenone (timbo root) and pyrethrum flowers, both used as insecticides, grow in Brazil. Production of pyrethrum is reported at around 1,000 tons a year. It is understood that a large United States company is building a pyrethrum extraction plant in Brazil. Nicotine is produced in small quantities from domestic tobacco. White arsenic is obtained as a byproduct from 2 gold-mining companies, with annual production estimated at approximately 1,500 tons, about half of requirements. The remainder is normally imported from Sweden.

According to local trade sources, there are 15 or more large chemical importing companies which mix pest-control products from imported raw materials.

Chemicals available for the manufacture of pesticides include sulfuric acid (produced at 17 plants); sulfur, with an output of about 2,500 tons a year, which is only a small portion of requirements; ethyl alcohol (produced from sugarcane), output in 1953–54 totaling 67.9 million liters; acetic acid, produced in quantities sufficient to meet demand.

Consumption

Local trade estimates that agriculture absorbs 85 percent of consumption, the remaining 15 percent being used for public health and household purposes.

The Syndicate of the Formicide and Insecticide Industry estimates Brazil's 1954 consumption of pest-control products as follows:

Product:	*Metric tons*
Sulfur, powdered	8, 240
Benzene hexachloride (12 percent gamma isomer basis)	7, 600
Copper compounds (sulfate, oxides, etc.)	4, 000
DDT (50 percent basis)	3, 000
Toxaphene (40 percent basis)	2, 660
Toxaphene (100 percent basis)	1, 000
Methyl bromide	2, 300
Miscible oils	500
Dithiocarbamate fungicides	400
Soil fumigants	220
Herbicides	200
Sodium cyanide	150
Thiophosphates (100 percent basis)	100
Lindane (100 percent basis)	15
Systemic insecticides	10
Total	30, 395

According to the syndicate, Brazil's 1954–55 import requirements for basic ingredients for formulation of pesticides are as follows:

Product:	*Metric tons*
DDT (100 percent basis)	5, 000
Diluents for insecticides	2, 550
Toxaphene	[1] 750
Paranitriphenyl	50
Emulsifiers, humidifiers, and dispersing agents	90
Red phosphorous	20

[1] A large inventory already on hand.

Other basic ingredients which, according to the syndicate, will eventually be imported in smaller quantities for production of certain types of pesticides are:

Potassium cyanide
Calcium cyanide
Piperonyl butoxide
Dieldrin
Aldrin
Dichlorobenzene compounds
Trichlorobenzene
Pentachlorophenol
Chlordane
Metaldehyde
Methylchlorophenoxyacetic acid and salts
Trichlorophenoxyacetic acid and salts
Sodium chlorate
Dinitro-ortho-butyl-phenol
Sulfur
Arsenic

Foreign Trade

See table 19 for 1953–54 imports of pesticides into Brazil. Official trade statistics give no indication that pest-control products are exported from Brazil.

The bulk of Brazil's imports of pesticides are by mixing and distributing companies which sell, under advertised brand names, formula-

Table 19.—*Brazilian Imports of Pesticides, 1953 and Jan.–June 1954*

[Quantity in pounds; value in U. S. dollars]

Commodity classification and principal countries of origin	1953		1954 (Jan.–June)	
	Quantity	Value	Quantity	Value
Copper sulfate:				
Belgium and Luxembourg	1, 515, 551	160, 494		
France	5, 638, 904	808, 805	979, 663	149, 479
Germany	663, 152	95, 053	1, 127, 255	199, 187
Japan			330, 690	48, 885
Netherlands	310, 331	47, 717	325, 399	64, 219
United Kingdom	817, 907	109, 828		
United States	777, 609	98, 130	596, 767	82, 453
Yugoslavia	1, 981, 338	290, 530	89, 906	14, 401
Other countries			103, 616	19, 510
Total	11, 704, 792	1, 610, 557	3, 553, 296	578, 134
DDT:				
France	143, 299	52, 966		
Italy	110, 230	28, 052		
Netherlands			110, 230	35, 059
United States	4, 451, 885	1, 298, 909	1, 263, 606	387, 436
Other countries	2, 205	1, 093	71, 650	25, 183
Total	4, 707, 619	1, 381, 020	1, 445, 486	447, 678
Benzene hexachloride:				
Denmark	4, 409	20, 441		
France	265, 059	54, 860	220, 460	48, 273
Germany	882, 795	261, 607	593, 606	288, 699
Italy	132, 496	32, 023	232, 916	35, 210
Japan	418, 874	74, 108	242, 506	40, 927
Netherlands			179, 840	37, 282
United States	2, 032, 813	377, 666	165, 464	53, 724
Total	3, 736, 446	820, 705	1, 634, 792	504, 115
Insecticides and fungicides, for "tillage and husbandry":				
France	608, 251	285, 975	65, 422	57, 763
Germany	409, 394	182, 827	835, 237	392, 650
Italy	132, 276	20, 324	32, 077	7, 548
Japan	132, 276	22, 482		
Netherlands			137, 181	48, 616
United States	2, 707, 546	1, 031, 945	1, 864, 556	1, 647, 746
Other countries	231	111	36, 239	27, 941
Total	3, 989, 974	1, 543, 664	2, 970, 712	2, 182, 264
Insecticides and fungicides, not elsewhere classified:				
United States	104, 194	77, 593	17, 762	12, 380
Other countries	37, 919	27, 568		
Total	142, 113	105, 161	17, 762	12, 380
Grand total	24, 280, 944	5, 461, 107	9, 622, 048	3, 724, 571

Source: Brazilian official trade statistics.

tions particularly designed for protection of the principal agricultural crops. Pest-control products are used chiefly on cotton, coffee, and, to a lesser extent, food crops. Brazilian farmers appear to prefer United States pesticides and, despite higher prices for some commodities, the United States probably will continue to be the principal supplier.

Equipment

Various types of portable sprayers and dusters are manufactured domestically, with output estimated at 10,000 units a year. Motorized spraying and dusting equipment is imported. Brazil's estimated annual requirements for various types of equipment are:

Types of equipment:	*Number of units*
Portable dusters	10, 000
Portable sprayers	8, 000
Motorized sprayers and dusters (including self-propelled and tractor types)	1, 000
Other types	500
Total	19, 500

Marketing and Distribution

Imports of pesticides are made largely by formulators, government agencies, and agricultural and trade associations. Government agencies and the associations are able to import at greatly reduced prices since foreign exchange is available to them at low rates. Barter arrangements, special credit terms, consignment imports, and other devices used by European and Far Eastern suppliers to combat United States dominance in the Brazilian market in other commodities do not appear to be important or effective in the pesticide field.

Consumers prefer to purchase from established companies who offer more liberal credit terms, supply products of consistent quality, and are a steady source for needed materials. Usual credit terms are 60 days, but 6 months to a year may be extended to a known and reputable planter. Often pesticides are not paid for until after the crop is harvested and sold. Almost no distribution is made through wholesalers or distributors since this would necessarily raise the price to the ultimate consumer.

Direct-contact advertising is considered most effective. Suppliers' agents, company representatives, and county agents communicate directly with planters and advise them on the most effective products for specific pest-control problems. Company trucks carrying advertisements, pamphlets, handbills, and inexpensive gifts bearing the name or trademark are all used for advertising. Articles describing up-to-date farming methods and mentioning names of products used for pest control are often published in newspapers or periodicals having wide distribution in agricultural circles.

Government Decrees and Regulations

Both imported and domestically manufactured or formulated pesticides must be approved and registered by the Federal Department of Agriculture before sale. Application for registration must be accompanied by a packaged sample, a certified chemical analysis of the product, instructions for its use, the name and address of the distributor, and the brand name or other identification. The Department, upon the basis of the chemical analysis, determines whether the product is properly packaged, effective and safe to use, and correctly labeled. The label must bear the brand or trade name, a statement of the active ingredients (with percentage of each), the weight or liquid content of the package (in metric units), the dosage recommended, and instructions for use. (Decree No. 24,114 of April 12, 1934, Apitulo VI, published in the *Diario Oficial* of May 4, 1934. A copy of this decree is on file in the Chemical and Rubber Division.)

Prospective Developments and Trends

It is suggested that United States investors and manufacturers of pesticides consider the possibility of producing basic toxic ingredients in Brazil. The present exchange system favors imports of these products, and domestically produced pesticides must compete with relatively cheap imports. Nevertheless, this situation has not prevented domestic manufacture of BHC, nor has it deterred United States companies from entering the pesticide field. Brazil probably will be short of dollar exchange for some time. Domestically manufactured pesticides which eliminate or reduce the necessity for imports are welcomed by the Brazilian Government and probably would prove profitable to the manufacturer.

The farsighted policies of Brazilian subsidiaries of United States companies appear to guarantee the favorable position of United States pesticides in this market. However, since the United States is the principal supplier, it is doubtful that its share of imports can be increased to any great extent.

CHILE

(Based on report by R. Guzman, U. S. Embassy, Santiago)

Production

Approximately 10 companies (8 in Santiago, 1 in Valparaiso, and 1 in Concepción) manufacture or formulate pesticides in Chile. Trade sources estimate current annual production at 3.6 million pounds of

lime sulfur and 1.9 million liters of miscellaneous pesticides, including bordeaux mixture, lead arsenate, DDT solution, formulations of chlordane, lethane, thanite, etc. Data on the amount of toxic ingredients used in this manufacture are not available. Annual copper sulfate production is approximately 450,000 pounds. Output of sheep dip containing the gamma isomer of BHC is about 550,000 pounds a year.

Raw materials manufactured in Chile for use in production of pesticides and annual capacity in pounds are:

Acetic acid	132, 000
Sulfuric acid	25, 000, 000
Creosote and "condensed oil"	8, 800, 000
Chlorine (liquid)	321, 500
Benzene hexachloride	40, 000

Phenol, cresol, cresylic acid, naphthalene, pyridine, and pyrethrum also are produced but data on output are not available.

Imports of raw materials for preparing pesticides, particularly emulsifiers, adhesives, and new toxic materials, are below domestic requirements because of the shortage of dollar exchange.

Consumption

The Chilean Ministry of Agriculture estimates 1954 consumption of pesticides as follows (in pounds):

Lead arsenate	555, 000
Sheep dip	555, 000
Agricultural sulfur	220, 000
DDT (100 percent basis)	88, 000
Fungicides	90, 000
Nicotine sulfate	46, 500
Chlordane insecticides	22, 000
Other pesticides	65, 000
Oils—liters	1, 000, 000
Weedkillers—do	60, 000

The Public Health Ministry estimates 1954 uses as follows (in metric tons): DDT, 40; rodenticides, 20; other pesticides, 30. Probable use in 1960 will increase 50 percent over that in 1954.

Foreign Trade

See table 20 for Chilean imports of pesticides in 1953. Chile's imports of prepared pesticides are relatively small, but imports of toxic ingredients for formulation in Chile are increasing. The United States and the United Kingdom are the principal suppliers.

The Chilean Ministry of Agriculture requested US$1 million in 1955 for importation from the United States of finished pesticides and toxic ingredients for their manufacture. The foreign exchange

budget allocated only US$272,000 for this purpose but allowed the equivalent of $600,000 in other currencies for importation of weed-killers and $130,000 to purchase winter oils.

Chilean exports consist only of sheep dip and some raw materials from the steel plant at Huachipato. Destinations are neighboring countries, cheifly Argentina. Once domestic demand is met, Peru and Bolivia also are potential markets.

Equipment

There are approximately 5,000 spraying and dusting units in Chile. The Ministry of Agriculture estimated 1955 requirements of imported equipment at $1.7 million, sufficient to purchase approximately 2,200 additional units. Ministry of Agriculture requirements for 1955, by specific types needed, were as follows:

	Units
Spraying equipment of 600 to 800 pounds pressure and capacity of 1,500 liters	250
Spraying equipment of 500 to 600 pounds pressure and capacity of 700 liters, with spraying bar for herbicides	400
Spraying equipment of 300 to 500 pounds pressure and capacity of 200 liters with spraying bar for herbicides and adjustable gauge	1, 500
Other spraying equipment	500
Total	2, 200

Lack of spraying units limits application of herbicides and materials for protection of fruit trees. Four local plants manufacture small spraying and dusting equipment.

Marketing and Distribution

Imported pesticides are generally obtained by direct purchase from the foreign supplier and distributed through local agents. Chilean manufacturers of prepared pesticides seldom sell through distributors, preferring to sell directly to retailers or to consumers.

Usual advertising media are newspapers, magazines, and radio programs. Little advertising by importers or agents for pesticides originates in countries other than the United States.

Government Decrees and Regulations

Before sale in Chile, a pesticide must be registered in the Trade Mark Department of the Ministry of Economy and approved by the Ministry of either Agriculture or Public Health.

Applications for imported raw materials or prepared compounds must be approved in advance by technicians of the Ministry of either Agriculture or Public Health and then by the National Foreign Trade Council.

Table 20.—*Chilean Imports of Pesticides, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Preparations for control of poultry insects:		
United States	14, 892	8, 000
Other countries	14, 462	2, 987
Total	29, 354	10, 987
Insecticides:		
United Kingdom	143, 623	44, 734
United States	294, 111	131, 570
Other countries	3, 924	5, 835
Total	441, 658	182, 139
Fungicides:		
United Kingdom	28, 968	9, 992
United States	359, 223	152, 444
Other countries	103	57
Total	388, 294	162, 493
Rodenticides, total	3, 146	2, 283
Cattle dips and sprays:		
United Kingdom	105, 431	69, 966
United States	7, 125	4, 925
Total	112, 556	74, 891
Other (not identified):		
Belgium	13, 210	48, 392
United States	84, 747	49, 832
Other countries	13, 882	5, 130
Total	111, 839	103, 354
Grand total	1, 086, 847	536, 147

Source: Chilean official trade statistics.

Prospective Developments and Trends

Recent industrial developments in Chile, such as the steel plant at Hauchipato, new rayon industries, and the paper industry, can furnish some byproduct raw materials for production of pesticides. Because of the high cost of importing finished pesticides and the dollar shortage, technicians of the Ministry of Agriculture are asking that the government permit importation of toxic ingredients only from which local formulators can prepare finished products, using domestic diluents. These technicians also have requested importation of mixing and packaging machinery.

The exchange shortage prevents imports of a wide selection of trademarked products, hence local consumers are familiar only with available commodities and do not have an opportunity for comparing the quality of various pesticides for particular purposes. There

is a demand for more United States pesticides than are now used but import permits for these commodities are not readily granted.

COLOMBIA

(Based on report by J. B. Richards, U. S. Embassy, Bogota)

Production

Pest-control products are not manufactured in Colombia. Domestic lime is mixed with copper sulfate to form bordeaux mixture. Sulfur is mined in fairly substantial quantities, but is inadequately refined for agricultural purposes. The only compounders and packagers of pesticides for retail sale are Shell Oil Company (aldrin dust) in Barranquilla, and Cia. Probst (toxaphene) in Medellin, both using imported toxic ingredients.

The Caja de Credito Agrario (Agricultural Credit Bank) has studied the possibility of compounding pest-control products, using imported active ingredients, but the plan has been discarded for the time being because of the expense. However, this project may be revived and would involve refining domestic sulfur, making dust formulations with Colombian diluents, mixing wettable powders from imported ingredients, and preparing emulsions from domestic petroleum and imported toxic materials. At present no tariff protection is given pesticide formulators. Should the industry develop, such protection probably would be extended and subsidies granted to protect farmers against price increases.

Consumption

Since there is little production of pesticides, consumption approximately equals imports. The Caja de Credito Agrario, a large consumer, ordinarily imports the following amount of pesticides, mainly for protection of cotton, potatoes, and bananas (in metric tons):

Aldrin		15–20
Calcium arsenate		90
Chlordane		200
Copper sulfate		910
DD (in 1955)		200
Dieldrin		15
Dithane		25
Toxaphene		50
Petroleum oils	gal	300, 000
2,4–D	do	50, 000

In addition, considerable amounts are imported by private firms.

The Public Health Service (Servicio Cooperativo Interamericano de Salud Publica) in 1953 imported 300,000 pounds of 75 percent DDT

and 20,000 pounds of dieldrin for use in the malaria-control program. A large chain of drug stores annually imports and sells about 22,000 pounds of various household insecticides, probably about 20 percent of retail distribution of such products.

Use of pest-control products (particularly 2,4–D) is steadily increasing and it is estimated that by 1960 consumption will be nearly twice that in 1954.

Foreign Trade

See table 21 for information on Colombian imports of pesticides in 1953. The United States was the principal supplier, followed by the United Kingdom and Germany.

There is no indication that Colombia exports pesticides.

Equipment

Adequate spraying equipment is available. Major banana growers use heavy equipment, usually consisting of tanks up to 500 gallons pulled by tractors (all from the United States). Cotton farmers are relying more and more on spraying and dusting by air; an estimated 50 percent of all major cotton plantations are thus sprayed. For potatoes and other crops, knapsack sprayers are used, which are imported and distributed by the Caja de Credito Agrario, as well as by agricultural supply companies. The Caja, which sells almost at cost, imported (almost entirely from Switzerland and Germany) and sold about 40,000 knapsack sprayers in 1954.

Switzerland and Germany supply sprayers with brass or copper tanks at a considerably lower price than those from the United States, although the United States offers galvanized steel tanks on a competitive basis. However, farmers will not accept the galvanized tanks, even though the Caja has recommended their use.

Marketing and Distribution

Most imports, including all those from the United States, are understood to be on a letter-of-credit basis. Some imports by private companies from European countries have been on 90-day terms. There seems to be no immediate danger that the United States will suffer severe losses of business because of more liberal terms offered by European suppliers despite the acute shortage of dollar exchange.

Considerable distribution of agricultural pesticides is through branches and agents of the Caja, with private firms distributing the remainder. Commodities for public health use are disseminated through the Public Health Service. Distribution of packaged goods for agricultural use is through hardware and agricultural supply

Table 21.—*Colombian Imports of Pesticides, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
Belgium and Luxembourg	1, 247, 495	133, 410
United Kingdom	3, 275, 317	364, 723
United States	4, 514, 060	505, 356
Yugoslavia	218, 255	33, 000
Other countries	103, 733	11, 480
Total	9, 358, 860	1, 047, 969
Nicotine sulfate—United States, total	3, 360	3, 220
DDT—United States, total	72, 500	21, 681
Calcium arsenate:		
United States	929, 725	54, 356
Other countries	134, 100	9, 868
Total	1, 063, 825	64, 224
Refined sulfur:		
Germany	69, 175	5, 367
United States	1, 365, 750	71, 274
Other countries	4, 875	830
Total	1, 439, 800	77, 471
Antifungus materials:		
United Kingdom	39, 268	8, 946
United States	72, 873	21, 788
Other countries	26, 082	4, 167
Total	138, 223	34, 901
Disinfectants and insecticides:		
Canada	109, 241	23, 961
Germany	507, 876	237, 902
Netherlands	71, 094	8, 531
United Kingdom	1, 759, 169	462, 499
United States	4, 050, 044	1, 197, 975
Other countries	26, 949	9, 997
Total	6, 524, 373	1, 940, 865
Grand total	18, 600, 941	3, 190, 331

Source: Colombian official trade statistics.

houses, while household insecticides are sold mainly through drug stores, some of which operate large chains and import direct.

Principal advertising media used by importers of pesticides are newspapers and agricultural trade journals. Radio is not much used. The Caja de Credito Agrario conducts promotional work among farmers, urging increased use of pesticides.

Government Decrees and Regulations

There are no government regulations affecting production or distribution of pesticides. A regulatory decree is reported to be under con-

sideration but has not yet reached concrete form. Most pesticides are imported free of duty but are subject to the exchange tax of 10 percent, payable when the import permit is granted. In addition, a deposit of 24 percent is required but is refunded when the product is actually imported.

Prospective Developments and Trends

It does not appear that good opportunities presently exist in Colombia for investment of United States capital or technical knowledge in the manufacture of pesticides. It is probable that fly sprays could be compounded locally from domestic oil and imported active ingredients and that copper sulfate, for which there is a fairly good market, could be made economically.

United States products already hold a major share of the Colombian pesticide market. Competition from European countries, particularly West Germany, may increase, but United States products are favored and should maintain their present share of the market unless there is a substantial change in relative prices.

ECUADOR

(Based on report by W. F. Gray, U. S. Embassy, Quito)

Production

Pesticides are not actually manufactured in Ecuador. Sulfur is mined in at least two locations, but is not ground in any quantity. Lime is available but usually contains considerable magnesium oxide which makes it unsuitable for formulating lime sulfur. An insecticidal oil is produced by a British-owned oil refinery. There is a limited amount of "one-room" formulation of insecticides.

Pyrethrum flowers are grown and a small amount of grinding is done by one firm. Two United States firms cultivate this crop at elevations of 11,000 feet on land which had long been idle because it was considered economically unproductive. Some pyrethrum is purchased by an Ecuadoran firm, but most is exported to the United States. Exports in 1953 were approximately 15 short tons, but in 1954 rose to 70 tons. One of the United States firms estimates production at 200 tons in 1955 and a possible 500 tons in 1956.

Consumption

No information is available on consumption. However, with little production of pesticides in Ecuador, consumption probably approximates imports. Ecuador has two distinct agricultural zones—the

highlands and the lowlands. In the highlands most agricultural crops are consumed locally. Principal crops requiring pesticides are potatoes, corn, peas, and fruit trees. For blight control on potatoes, bordeaux mixture, new organic fungicides, and insoluble copper compounds are used. DDT controls most insects on potatoes, but other organics are also used. Stored corn is treated with pyrenone and lindane. Pea crops need sulfur to protect them from powdery mildew. Most fruit trees need copper compounds for control of lichens, moss, and other parasitic growths. Apples are badly infested with scab and powdery mildew which can be controlled with sulfur and some organic fungicides. Citrus trees must be sprayed with oil or be killed by scale insects.

In the lowlands, crops are grown for export and include bananas, cacao, coffee, rice, cotton, citrus, and sugarcane. Insecticides used are chiefly DDT, BHC, and toxaphene on cotton; oil on citrus; and toxaphene on cattle. Some DDT and toxaphene are used against armyworms on rice. Work is starting on the use of fungicides against sigatoka disease on bananas. Other crops generally are not treated, although the sugarcane borer heavily infests sugarcane, coconuts cannot be grown because of borers, and cacao diseases are serious.

Foreign Trade

See table 22 for information on 1953 imports of pesticides into Ecuador. Imports are on the increase. Many United States producers of pest-control products have agencies in Guayaquil and Quito, and some have field men to demonstrate their products to increase sales. British, German, and Swiss pesticides are also available in Guayaquil and Quito, and German products are coming into the country in increasing amounts.

Table 22.—*Ecuadoran Imports of Pesticides, 1953*

Commodity classifications and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Disinfectants and insecticides:		
United Kingdom	140, 650	1, 085
United States	1, 230, 203	23, 807
Other countries	147, 345	2, 351
Total	1, 518, 198	27, 243
Copper sulfate:		
Chile	7, 646	50
United States	69, 625	509
Total	77, 271	559

Source: Ecuadoran official trade statistics.

Equipment

In the highlands very little power equipment is used because of lack of capital, dearth of skilled workers, backward farming methods, and cheap Indian labor. For potatoes and most other crops knapsack sprayers are used. Very few dusting machines are in use because of the high cost of importing bulky dust materials.

In the lowlands, fixed-nozzle boom sprayers are used by a few large haciendas, but the maximum size is 3 to 4 rows. Larger units are not generally needed. There is definitely a need for 2-row, traction-powered, man- or animal-pulled sprayers and dusters. Small engine-powered, man-carried units could also be used.

Marketing and Distribution

United States products are equal in quality to those imported from other countries but are often more expensive. United States pesticides are in more general use, but the percentage of cheaper priced European products is likely to increase. Methods of payment and credit terms were not reported, but it was indicated that no barter transactions take place.

Government Decrees and Regulations

There are no special regulations affecting production and distribution of domestic and imported pest-control products. Pesticides generally are subject to very low import duties and, for the most part, are included in list I of the Foreign Exchange Law which permits importation at a more favorable official rate of exchange.

Prospective Developments and Trends

In the near future there undoubtedly will be an increase in the formulation of pesticides in Ecuador. Freight costs are high and inert domestic materials are available. Dust formulations are preferable generally because of the shortage of water and ease of application. It has been estimated that only 5.5 percent of arable land is under cultivation, but the government is building roads and opening more of the country for settlement. Hence, an increasing amount of agricultural activity can be expected and a consequent rise in requirements for pesticides.

The International Cooperation Administration conducts a technical aid program in agriculture with a specialist in entomology who is instructing national agronomists and farmers in the use of insecticides and fungicides. The Technical Aid Program has recently established an extension service in four provinces and effective work already is

being done. Other specialists in horticulture, plant breeding, soils, cattle, etc., are improving agricultural practices in Ecuador.

An effective means of promoting sales of pesticides is by sending qualified United States technicians to Ecuador to advise in the use of products and equipment and to train agronomists. This method of promotion is presently more used by European firms than by those in the United States. Farmers usually will buy products which they are convinced will pay for themselves in results. Rapid service is also fundamental in improving the competitive position of United States pesticides. Complaints are heard that orders from Europe are delivered in Guayaquil in 30 days, while those from the United States require 6 months.

PARAGUAY

(Based on report by S. P. Miller, U. S. Embassy, Asunción)

Production

Manufacture of pesticides in Paraguay is limited to the compounding of an insect spray (composed of imported 5 percent DDT and kerosene) and espirales (slow-burning punks made from pyrethrum, sulfur, and cow dung), said to be effective as mosquito repellants. The insect spray is not packaged but is simply drawn from barrels into customers' bottles. Although espirales are not advertised, they are well packaged, widely known locally, and enjoy a small export market to northern Argentina.

Raw materials locally available for manufacture of pesticides are tobacco, sulfur, pyrethrum, and lime.

Consumption

Customs records indicate that 241 metric tons of pesticides—223 metric tons of ant killers and 18 tons of general insecticides—entered Paraguay in 1953. Argentina was the source of 62 percent of these imports; 22 percent originated in Germany, 15 percent in the United States, and 1 percent in Brazil.

Some imports by government agencies are not recorded by the customs office, and other sources indicate that actually about 400 metric tons of pesticides were imported in 1953, including 196 tons by the Bank of Paraguay, 129 tons by the Supervised Farm Credit Agency, and 8 tons by the Point IV Agricultural Division. The Bank of Paraguay imported 296 tons of pesticides in the first 8 months of 1954, and Supervised Farm Credit Agency imports also are increasing.

Should agricultural acreage remain static, it is estimated that the demand for pesticides will increase to 1,000 tons a year. This increase

would be due largely to continuing education of small landholders by Point IV personnel and to a rise in consumption of insecticides, grain protectants, and fungicides by large agricultural ventures.

However, the Paraguayan Government is encouraging the stepping up of cultivation by every conceivable means. Paraguay is fundamentally an agricultural country, but only 1 percent of its land area is under cultivation and the country is not self-sufficient in food crops. Increased production is sought by colonization, teaching of modern farming methods, and other means. Since the main emphasis is on an increase in subsistence farming on small farms, a rise in land use will not necessarily mean a proportionate increase in consumption of pesticides. Nevertheless, should land use double by 1960, as the government desires, pesticide consumption might reach 1,500 tons a year.

Foreign Trade

Official trade statistics on imports of pesticides into Paraguay are not available. (See import data under "Consumption.")

Traditionally, the bulk of Paraguay's trade, both export and import, is with Argentina. This pattern was recently strengthened by the conclusion of a series of economic conventions with that country. However, Germany, Italy, and France are again becoming important suppliers of chemicals and consumer goods, largely because of more liberal prices and credit policies than are offered by United States and United Kingdom firms.

Equipment

The average Paraguayan farmer, with less than 5 acres under cultivation, has still to learn the use and value of pesticides and pesticide equipment. He needs simple hand dusters and sprayers and instructions on how to use the equipment efficiently. Work is being done in this field by Point IV extension agents, both in training of farmers and in combating specific plagues such as cutter ants, and by the Supervised Farm Credit agency in general work with insecticides and fungicides. Both agencies are hampered by lack of equipment.

Specific needs are for cheap, simple spraying and dusting equipment for individual farmers, gas applicators (for such commodities as methyl bromide), and antilocust equipment for government use.

Marketing and Distribution

Most official purchases of insecticides are made by irrevocable letter of credit or by bank draft payable cash against documents. These methods prevail because most recent official purchases have been made

from International Bank loan funds. Theoretically, commercial purchases are made cash against documents. In actual practice, however, this becomes paying in cash against receipt from customs. Consequently, many European firms are now giving short-term credits. This practice is especially prevalent in the case of pesticide imports from trade- and payments-agreement countries, such as Argentina, Germany, and France. European firms also accept payment in currencies other than their own.

The bulk of official imports is distributed to farmers through branch offices of the Bank of Paraguay and district offices of the Supervised Farm Credit Agency, although the latter agency also has consigned supplies to the Ministry of Agriculture for stockpiling and eventual delivery to the Permanent Anti-Locust Committee. Point IV pesticide imports are distributed through agricultural extension offices. In these offices emphasis is on teaching and demonstration, directed mainly at implanting the habit of using pesticides for particular purposes rather than at promoting large-scale commercial operations.

Most Paraguayan farmers speak an Indian dialect rather than Spanish, hence newspaper advertising is of little importance. To date the most effective method of advertising has been word-of-mouth recommendations—from fellow farmers, storekeepers, bank and credit agents, and the village chiefs. However, benefits from use of pesticides became known very slowly until Point IV extension agents began practical demonstrations. It is believed that the most productive advertising United States firms could use would be practical field demonstrations. Considering the extreme difficulty of such a project, sound movies and simple, instructive printed materials would be the best media. All advertising should be instructional in nature; the most active channel of distribution would be through the local ICA agricultural mission.

Government Decrees and Regulations

With the exception of official agencies, organizations engaged in trade in chemicals must be headed by a licensed pharmacist or chemist. Import licenses are not required, but all foreign-exchange transactions are subject to approval by the Central Bank of Paraguay. Exchange rates on imports are set at various levels, according to essentiality of the products. Pesticides in bulk enter at a preferential exchange rate as essential goods. Once in the country, imports are subject to price fixing, distribution controls, and rationing.

Prospective Developments and Trends

Within the foreseeable future, the Paraguayan pesticide industry will probably be limited to compounding and packaging of imported

products. The Paraguayan Government is interested in new industries which will save an expenditure of foreign exchange, or those with an export potential. However, high freight rates and shortage of labor, power, and water militate against foreign investment in Paraguayan industry at the present time. Technical chemical knowledge is no problem; currently, there is an excess of licensed chemists in Asunción.

United States firms might gain an immediate advantage in the pesticide market in Paraguay by advancing short-term credits and accepting payment in soft currencies. Paraguay is a new and expanding, although small, market for pesticides, and buying habits are now being formed. United States companies could assure their position in the market through technical aid and practical demonstrations, distribution of simple low-cost equipment, and instructional literature.

PERU

(Based on report by C. Camilloni, U. S. Embassy, Lima)

Production

The 1953 output of the major pesticide manufactured in Peru, calcium arsenate, totaled 2,970,000 pounds, against 2,331,000 pounds in 1952. Copper sulfate production was 2,476,000 pounds in 1953, but only 150,000 pounds were used as a fungicide.

In recent years four insecticide compounding plants have gone into operation, processing imported technical products by using largely domestic inert materials. The principal imported concentrates processed by these plants are DDT 50 percent, BHC 12 percent, aldrin 25 and 40 percent, and toxaphene 40 percent. Although there is no information on volume of formulations produced, it is estimated by the trade that local plants supply about 60 percent of consumption in the case of BHC, 40 percent for toxaphene, and 30 percent of both DDT and aldrin.

Peru's 1953 sulfur production was 10 million pounds, but not more than 100,000 pounds were used for pesticides because of poor dusting quality. In 1954 a small plant was installed for producing agricultural sulfur. The owner claims to have produced and sold in the first 8 months of 1954 about 600,000 pounds of dusting sulfur of 325 mesh, and reports that additional locally made equipment will enable him to increase production to 4.4 million to 5.5 million pounds annually.

Production of "Babbini," a domestic agricultural insecticide prepared from Chile pepper, cebadila (an Indian caustic barley), arsenic, and quicklime, was about 535,000 pounds in 1953. This product has enjoyed a fairly good demand in previous years for control of certain

cotton pests, but is losing ground due to local preference for imported preparations.

There is only one important producer (Cerro de Pasco Corporation) of calcium arsenate and copper sulfate, and five compounding plants (Du Pont Peru S. A., Agricultural Chemicals del Peru, Peru Mercantil, S. A., La Fabril, S. A., and Planta Piloto of the Ministerio de Agriculture). All raw materials for production of calcium arsenate, copper sulfate, dusting sulfur, and "Babbini" are obtainable in Peru. The formulating plants depend entirely on foreign suppliers for requirements of toxic ingredients but use domestic talcum as the inert material for 75 percent of production. The remaining 25 percent consists of certain imported clays for producing wettable powders.

Annual output of household insecticides—120,000 pounds—indicates the small size of the industry. There is little local manufacture of animal sprays and dips. For production of household insecticides about 10 tons of pyrethrum (equal to domestic output) and 5 tons of technical DDT of foreign origin are used. Kerosene is in ample supply. Peru is a major world producer of cube (a rotenone-bearing root), but very little is used for the manufacture of pesticides. Domestically produced chemicals which could be used in the manufacture of pesticides include ethyl alcohol, sulfuric acid, and chlorine.

Consumption

Based partly on information published by the Peruvian Ministry of Agriculture, but mostly on data from leading members of the trade, annual current consumption of major pesticides in Peru is estimated as shown in table 23.

It is estimated that agriculture accounts for over 95 percent of pesticide consumption. Cotton, sugar, potatoes, rice, corn, wheat,

Table 23.—*Estimated Current Annual Consumption of Major Pesticides in Peru*

[Pounds of toxic ingredients]

Commodity	Agricultural use	Total
Dusting sulfur (325 mesh)	5, 500, 000	5, 500, 000
Calcium arsenate	3, 500, 000	3, 500, 000
DDT (100 percent basis)	280, 000	550, 000
BHC (technical basis)	250, 000	265, 000
Toxaphene (100 percent basis)	250, 000	250, 000
Aldrin, dieldrin, etc. (25 percent basis)	150, 000	170, 000
Copper sulfate	200, 000	200, 000
Phosphatic insecticides	150, 000	150, 000
Parzate, dithane, etc	100, 000	100, 000
Nicotine sulfate (40 percent basis)	50, 000	50, 000
Oil emulsions—gallons	125, 000	125, 000
Weedkillers—gallons	20, 000	20, 000

Source: Peruvian Ministry of Agriculture and trade sources.

vegetables, and fruits are the principal products requiring protection, but cotton is the major pesticide-consuming crop. Reliable trade sources estimate that not less than 85 percent of agricultural pesticides consumed is used on cotton fields, particularly for combating the leafworm, bollworm, Peruvian boll weevil, aphids, red stainer, oidium, and a fungus called "chupadera."

Current consumption of household insecticides is estimated at approximately 50,000 gallons a year, of which about 40 percent is supplied by domestic manufacture. Demand is increasing very slowly.

A 5-year program initiated by the Peruvian Health Department in 1953 calls for annual consumption of about 260,000 pounds 100 percent ĐDT and 15,000 to 20,000 pounds of BHC (25 percent) or its equivalent in aldrin, together with small quantities of warfarin and calcium cyanide, mainly for combating malaria, Chagas' disease, typhus, fleas, and rats.

Consumption of animal dips and sprays, estimated at 250,000 pounds yearly, should expand in the next few years because of greater interest in improving sanitary and health conditions on cattle and sheep farms.

It is generally believed that normal consumption of major pesticides should increase steadily at about 10 percent a year, although some commodities presently used may be displaced by newer or more effective products. Additional areas will be opened for cultivation through ambitious irrigation programs, and Peruvian agriculturists are becoming increasingly aware of the importance of pesticide use.

Foreign Trade

Increased requirements are indicated by a considerable rise in imports. Imports of all pesticides into Peru in 1948 totaled around 7 million pounds, and by 1953 had attained 16 million pounds. Between these years imports of dusting sulfur increased from 606,000 to 6,190,000 pounds; DDT from 218,000 to 523,000 pounds; and the group comprising general agricultural insecticides, fungicides, etc., from 5,232,000 to 8,100,000 pounds.

The United States is the principal supplier of pest-control products to Peru (see table 24); West Germany is the strongest competitor.

Formulating of pesticides is a rather new industry and output is intended for domestic consumption. Production of calcium arsenate is not sufficient to warrant sales abroad. The bulk of copper sulfate output is consumed by the domestic mining industry. Therefore, sizable exports are not likely in the near future.

Equipment

Sprayers and dusters are in adequate supply. Hand-operated types are the most popular, but use of power models is expanding as a result

of increased pesticide application on large farms. Small insecticide mixers also are gaining popularity among large farmers and progressive agriculturists who desire to formulate their own insecticide mixtures. This reduces cost and enables the most needed mixtures to be prepared at the right time.

Table 24.—*Imports of Pesticides into Peru, Fiscal Year 1951–52*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
Chile	41, 535	4, 829
United States	883, 444	118, 296
Other countries	7, 842	1, 093
Total	932, 821	124, 218
Paradichlorobenzene, total	21, 714	3, 923
Disinfectants, insecticides, fungicides and related products:		
United Kingdom	117, 428	9, 483
United States	76, 632	15, 905
Other countries	23, 278	3, 651
Total	217, 338	29, 039
DDT:		
United Kingdom	264	257
United States	595, 586	282, 605
Total	595, 850	282, 862
Insecticides and fungicides for agricultural use:		
Germany	1, 480, 287	142, 479
United Kingdom	185, 733	48, 873
United States	7, 175, 204	1, 501, 360
Other countries	63, 894	23, 851
Total	8, 905, 118	1, 716, 563
Insecticides and fungicides for household use:		
United States	74, 186	64, 904
Other countries	2, 004	2, 753
Total	76, 190	67, 657
Grand total	10, 749, 031	2, 024, 262

Source: Peruvian official trade statistics.

Airplane dusting and spraying for insect, disease, and weed control is relatively new but has been employed on cotton and sugar farms with remarkable success. There are at present four local airplane companies operating a total of 54 dusting planes, and a gradual increase in the fleet is anticipated. In July 1954, a helicopter was brought to Peru for public demonstrations in agricultural dusting. Several local concerns have expressed interest in using helicopters in agricultural spraying and dusting operations.

Marketing and Distribution

Although United States pesticides are usually somewhat higher in price than other imported products, they enjoy the greatest demand in Peru because of high quality. Principal channels for distribution of imported pesticides are local agents and direct representatives of foreign producers or exporters. European suppliers customarily sell on 90-day sight drafts, either for purchases made by importers or for orders placed for direct shipment to consumers. Trade sources indicate that United States suppliers are now granting similar payment facilities and earnestly recommend that this practice be continued as it has proved to be an important aid in offsetting European competition. Price considerations are especially strong in the Peruvian market. No barter or other special agreements are employed.

Pest-control products are advertised chiefly through newspapers, agricultural publications, and direct mail. Some use is also made of radio advertising and billboards. Sound films are shown occasionally at conventions and meetings of farmers, with reported success.

Government Decrees and Regulations

Importation, manufacture, and trade of agricultural pesticides are governed by provisions of Supreme Resolution No. 427 of December 29, 1950. Pursuant to these regulations, sales of pesticides are subject to prior approval by the Ministry of Agriculture. Manufacturers, importers, and dealers are required to submit samples of products for analysis and biological tests to the Division of Agricultural Defense, and results of these tests are reported to the Ministry of Agriculture for approval or rejection. Upon approval, pesticides must be registered with the Division of Agricultural Defense, such registration, valid for 3 years, being subject to a fee of 100 soles (about $5) for each product. Date of approval and registration number must appear on containers, together with clear indication in Spanish of the chemical formula or composition, date of manufacture (if the product is subject to obsolescense), and instructions as to use. Labels for poisonous products must show clearly the word "VENENO" (poison) in red, as well as precautions to be taken and suitable antidotes. Labels must also identify products of an explosive or inflammatory nature. Advertising or distribution of products not previously approved for sale is strictly prohibited. Manufacturers, importers, and dealers are required to submit to the Ministry of Agriculture quarterly reports indicating the kind and quantity of each product manufactured, imported, or sold. Products sold without compliance with these regulations are subject to confiscation and fines varying from $25 to $500 are imposed on the sellers.

Domestic manufacture, importation, and sale of pesticides for human, household, and veterinary use are subject to the provisions of

a Supreme Decree of May 26, 1944, as amended by Supreme Decree of November 4, 1952. In general, these regulations are similar to those pertaining to agricultural pesticides, but the registration fee for each product is 250 soles ($12.50), and registration is valid for 5 years.

No import restrictions or quotas are applicable to pest-control products. On the contrary, the Peruvian tariff accords duty-free entry to agricultural pesticides, DDT, certain disinfectants, rodenticides, seed and grain fumigants, and animal dips and sprays, as a means of promoting their increased use.

Prospective Developments and Trends

At present, 2 United States concerns operate pesticide-formulating plants, and 1 leading manufacturer of household insecticides has a factory in Peru. The size of the market does not seem to justify investment of additional United States capital or technical knowledge.

Prospects are good for a continuing large or increased participation of United States pesticides in the Peruvian market. Requirements are steadily growing and local preference is for United States products. It appears reasonable to expect a decline in imports of calcium arsenate and formulations because of domestic production, but it is anticipated that the United States will supply most of Peru's increasing needs for sulfur, new organic pesticides, weedkillers, and oil emulsions.

United States products are sold in Peru largely because of high quality and it is most important that this well-earned prestige be maintained. It has been reported that occasionally United States exporters or brokers ship to Peru surplus stocks which do not conform in quality to those received from well-known manufacturers, thus causing an unfavorable reaction among consumers.

An important element in the increased consumption of pesticides in general is the work done by SCIPA (Servicio Cooperativo Inter-Americano de Produccion de Alimentos), a joint Peruvian-United States technical agricultural service. SCIPA prepares periodic reports on pest-control problems and promotes the use of these products through widely distributed magazines and technical bulletins. It also distributes at cost pesticides to small agriculturists.

URUGUAY

(Based on report by E. N. Isola and A. J. Barcelo, U. S. Embassy, Montevideo)

Production

There is no actual production of pest-control products in Uruguay, but approximately 12 firms engage in the processing and/or mixing of

imported raw toxic materials or semimanufactured concentrates. Raw materials for the manufacture of pesticides are not available, with the exception of copper for copper sulfate. Even kerosene is imported.

High import duties and classification of pesticides under Category III (nonessential items) by the Export and Import Control Office protect these manufacturers against importation of finished pesticides.

Consumption

Principal pesticides (toxic ingredient) consumed in Uruguay are as follows (in pounds unless otherwise stated):

Copper sulfate	pounds	1, 100, 000
Other copper compounds	do	110, 000
Sulfur	do	300, 000
Lead arsenate	do	275, 000
Bordeaux mixture	do	90, 000
Lindane [1]	do	88, 000
Seed treatment materials	do	5, 280
Emulsive oils	gallons	71, 335
DDT	do	16, 000
Weedkillers	do	11, 100
Chlordane	do	1, 000

[1] This is the usual consumption of lindane concentrate. Consumption for locust control, when plagues are imminent, might go as high as 1,500 metric tons.

Treatment of grapevines and fruit trees takes the major portion, with the remainder being used to protect other agricultural crops. Household use is small, probably totaling around 3,000 gallons (DDT base) a year.

Although farmers and cattlemen are using more pesticides, because of larger crops and the intensive advertising campaigns by pesticide producers, consumption is expected to increase slowly.

Foreign Trade

The only import statistics available cover "products for combatting pests," which in 1953 totaled 511,606 pounds valued at $131,957. No breakdown on countries of origin is available.

Until 1952 the United States was the principal supplier of toxic ingredients and concentrates for Uruguayan formulation of pesticides. However, due to the shortage of dollar exchange, importers have had to turn to European countries such as the United Kingdom, Germany, and France.

Equipment

Spraying and dusting equipment is in adequate supply. Stocks are controlled by the principal pesticide distributors who also are equipment dealers.

Marketing and Distribution

Principal channels of distribution are agents or representatives of foreign firms. Terms of sale for United States products are evidently comparable with those for imports from other countries.

The best advertising media are instructions to the public as to damage done by insects, mites, and rodents. Recommendations from public health organizations and ICA personnel also carry considerable weight.

Government Decrees and Regulations

The Export and Import Control Office classifies imports of pesticides into two groups: Totally manufactured, which are included in Category III (nonessential), imports of which are limited; raw materials and "concentrates" to be formulated in Uruguay, which are included in Category I (essential) and receive preferential treatment with regard to import permits. The rate of exchange for Category III items is 2.45 pesos per United States dollar, and for Category I, 1.90 pesos to the dollar.

The Ministry of Public Health regulates the use of poisonous products.

Prospective Developments and Trends

Prospects for investment of United States capital in the pesticide industry of Uruguay are not favorable. Formulating procedures are so simple that there is no need for United States technical knowledge, but there is a possibility that know-how would be of use in the manufacture of copper sulfate since plans are under way to produce this pesticide from native copper.

An increase in the United States share of the Uruguayan pesticide market depends on greater dollar-exchange availability, or on manufacture by United States firms of their products in Uruguay under license.

VENEZUELA

(Based on report by F. Maresch, U. S. Embassy, Caracas)

Production

Two formulating plants in Venezuela (Pennsalt-Comanil, C. A., and Insecticidas y Abonos, with capital investment from Compania Shell de Venezuela, Ltd.) mix imported raw materials to produce finished insecticides and fertilizers. The formulation of fungicides has not yet been undertaken. No domestic materials, other than petroleum, are locally available for formulation of pesticides. An

estimated 75 percent of the raw materials, including inerts, used by these enterprises is imported from the United States, 20 percent from the United Kingdom, and 5 percent from Germany.

Present annual output of these two plants is estimated at 1,400 metric tons of insecticides. Of this output, the largest selling insecticide for agricultural use—toxaphene—represents approximately 60 percent; DDT powder (10 to 20 percent content), 20 percent; and chlordane, aldrin, BHC, parathion, etc., 20 percent. The Pennsalt-Comanil plant is presently attempting to produce emulsions. Although sulfur has been used for dusting, application is now largely confined to mixture with BHC for control of onion thrips. Sulfur is not used in cotton insecticides in Venezuela and present consumption is estimated at only 20 metric tons a year.

The above plants package their dusting products in locally made paper bags. Small quantities of liquid insecticides are mixed and marketed in unlined oil drums.

Consumption

Present insecticide consumption (probably as finished products) is estimated as follows:

	Metric tons
Agriculture:	
Toxaphene	1,200
DDT (10–20 percent)	400
Endrin	100
BHC	150
Chlordane	60
Aldrin	60
Parathion, etc	30
Lead arsenate	20
Calcium arsenate	
Total	2,020
Public health:	
DDT (1–10 percent content)	500
Chlordane, aldrin, dieldrin, etc	100
Total	600
Household and industrial:	
DDT (1–5 percent solutions)	1,200
Pyrethrum preparations, chlordane, etc	300
Total	1,500
Grand total	4,120

Of the 2,020 metric tons of insecticides used in agriculture, 1,400 tons are locally formulated and the remainder imported as finished products.

Copper sulfate is used as a fungicide and consumption is estimated at 20 metric tons a year. Consumption of all types of weedkillers is estimated at 450 tons; 150 tons are imported products and 300 tons are domestically produced material manufactured by Compania Shell de Venezuela, Ltd.

If the prosperous conditions which have characterized the Venezuelan economy over the past 10 years continue, consumption of pesticides may be expected to increase. However, in view of the rapidly changing conditions and improvements in the formulation of pesticides, it is impossible to predict the pattern of usage.

Foreign Trade

The only available statistics on imports of pesticides into Venezuela are shown in table 25. The United States has continued to maintain its dominant position and supplies approximately 75 percent of requirements.

Equipment

Dusting is still dominant, but owing to abundant rains during the growing season, sprays are preferable for many uses. There is an inadequate supply of low-pressure-low-volume group sprayers. Although three airplane crop-dusting and -spraying companies operate in Venezuela, their services have not been widely used.

Marketing and Distribution

Pesticides are distributed through local agents, who sell to consumers and to the government. Occasionally government purchases are made direct from a foreign supplier and are distributed to farmers by

Table 25.—*Imports of Pesticide Materials into Venezuela, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Salts and oxides of arsenic:		
Germany	117	8
United States	2, 480	230
Total	2, 597	238
Salts and oxides of copper:		
Belgium	132, 275	14, 178
United States	128, 793	24, 681
Other countries	51, 835	6, 467
Total	312, 903	45, 326

Source: Venezuelan official trade statistics.

either the Venezuelan Development Corporation or the Ministry of Agriculture.

United States pesticides are not widely advertised in Venezuela. Since they are marketed by agents and are used by local formulating plants, only a small amount of advertising has been considered necessary.

Government Decrees and Regulations

Decree No. 433, published in Gaceta Oficial No. 23,898 of August 2, 1952, strictly regulates importation, mixing, and distribution of agricultural pesticides and also gives the Minister of Agriculture authority to dictate the substances to be used, or to prohibit the use of certain materials, for the control of any pest. The Food and Drugs Section of the Ministry of Health and Welfare controls licensing for sale of household and industrial insecticides.

All imported prepared pesticides are granted duty-free entry in the Venezuelan customs tariff law.

Prospective Developments and Trends

Since petroleum is the only raw material available in Venezuela for production of pesticides, there is little opportunity for use of United States capital in developing the pesticide industry. While opportunities may exist for establishment of formulating plants, it is important to note that locally processed pesticides receive no customs protection and must compete with duty-free imported products.

The United States already enjoys 75 percent of the Venezuelan market for pesticides, hence opportunities for further participation depend on obtaining a share of the 25 percent now going to other suppliers or on increased consumption. New and better pesticides are always welcome in Venezuela. Hence, should some country other than the United States develop a highly effective pesticide with low toxicity to warm-blooded animals, the market would likely veer in that direction.

United States suppliers would gain an advantage through financing agents to enable them to carry adequate stocks of pesticides. At present, only small amounts of pest-control products are stocked because local importers are unwilling to take the risk of carrying large supplies of materials for fear new and more effective products will enter the market.

Europe

The United Kingdom has always been a competitor of the United States in world pesticide markets. However, in recent years, even keener competition has arisen from Central European countries, particularly West Germany. Since World War II, numerous countries in this area have gone into production of the newer pesticides, such as DDT, BHC, lindane, and phosphatic insecticides. Reports indicate that credit terms given by these countries are more lenient than those offered by United States firms and that in some cases quoted prices are lower. Undoubtedly, increasing competition from this area will occur.

Despite greater production, Europe still remains a sizable market for United States pesticides. Exports to that continent were 56 percent higher in value in 1954 than in 1953, but in 1955 were only 19 percent above those in 1954.

AUSTRIA

(Based on report by M. V. Ockey, U. S. Embassy, Vienna)

Production

No official data on production of pesticides in Austria are available. Pesticides are produced largely by chemical manufacturers, many of whom are small firms which manufacture these products when demand warrants and discontinue output as requirements slacken. Domestic production practically meets demand.

According to estimates from private sources, the following pesticides are produced by 23 manufacturers in Austria:

	Annual output (metric tons)
Carbolineum (a mixture of coal-tar derivatives)	800
Lindane	3–5
Refined naphthalene	640
Copper sulfate	1, 500
Nicotine extracts	5–20
Sodium chlorate	50
Finished pesticides (insecticides based on DDT, lindane, and other toxic ingredients), weedkillers, rodenticides, etc	2, 400

Consumption

Consumption statistics are unavailable. According to Fachwerband der Chemischen Industrie, value of annual sales of pesticides, excluding copper sulfate, was approximately $8.5 million in the years 1951–53. In addition to this figure, an annual average of $4 million was spent to buy 2,000 metric tons of copper sulfate to be used in combatting peronospara disease on vineyards. Probably from 90 to 95 percent of pesticides are consumed in agriculture.

It seems logical to expect some increase in agricultural use of pesticides in Austria, but under the most favorable conditions consumption probably will not rise more than 10 to 15 percent in the next 5 years.

Foreign Trade

Since 1952, Austrian imports of ready-to-use pesticides have been relatively unimportant. In 1951, 140 metric tons were imported; in 1952, 47 tons; in 1953, 41 tons; and in the first 6 months of 1954, 17 tons. Available information points to a decreasing trend in imports of finished pesticides and an increase in imports of toxic pesticide ingredients not produced in Austria. Imports of pesticides and toxic ingredients from the dollar area still require import licenses.

Equipment

There are three large and a number of small Austrian manufacturers of spraying and dusting equipment which supply not only the domestic

Table 26.—*Austrian Foreign Trade in Pesticides, 1953*

Commodity and country of origin	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Insecticides, fungicides and the like:		
West Germany	127, 600	51, 760
Switzerland	88, 400	25, 000
United States	22, 000	16, 000
Other	3, 900	1, 320
Total	240, 900	94, 080
EXPORTS		
Copper sulfate, Italy, total	739, 200	72, 000
Insecticides, fungicides and the like:		
Argentina	10, 800	9, 480
Italy	22, 000	1, 000
Other	2, 400	6, 520
Total	35, 200	17, 000

Source: Austrian official trade statistics.

market but also produce for export. Apparently this equipment is satisfactory.

On May 20, 1953, the Austrian Central Statistics Bureau conducted a countrywide machinery census. Published statistics indicate that on that date there were 7,190 horse-drawn and 1,703 power-operated dusting and spraying units in Austria. The number probably has increased since that time.

Marketing and Distribution

Recently, a number of large Austrian pesticide manufacturers have entered into licensing agreements with West German or Swiss firms for production of specific pesticides. For example, F. Joh. Kwizda, Chemische Fabrik, produces DDT under a licensing arrangement with J. R. Geigy, A. G., Basel, Switzerland, and the Austrian Nitrogen Works and Chemia Chemikalien Handelsgesellschaft have close working arrangements with Farbenfabriken-Bayer, A. G., Leverkusen, Germany. A few German, Swiss, and one Netherlands firm market their products in Austria under private brand names.

Government Decrees and Regulations

Production and distribution of pest-control products are governed by the Plant Protection Law, Federal Law Gazette No. 29, July 12, 1948, and an ordinance of May 25, 1949, issued by the Federal Ministry of Agriculture and Forestry. The legislation stipulates that only those pesticides which have been entered in the official register of pest-control products on the strength of a license granted by the Federal Ministry of Agriculture and Forestry, may be manufactured on a commercial scale, used, sold, offered for sale, or otherwise marketed in Austria. Such licenses will be granted only if the pest-control product has been tested by the Federal Institute for Plant Protection and found to meet requirements.

The intent of the Plant Protection law is to bar from the domestic market pesticides which are found to be unfit for use under Austrian conditions. A list of all pesticides presently registered, together with names of companies selling pesticides in Austria and firms producing spraying, dusting, and other pesticide equipment, are given in the publication *Der Pflanzenarzt.* (Loan copies of this publication are on file in the Chemical and Rubber Division.)

Prospective Developments and Trends

The Austrian chemical industry, which includes production of pesticides, is fairly well developed, appears to be meeting present pesticide requirements and to have enough flexibility in production capacity

to meet foreseeable increases in demand. Nevertheless, opportunity continually exists for development of new and more effective products.

Under present conditions, prospects for increased United States participation in the Austrian pesticide market do not appear promising. While it is possible that Austrian pesticide manufacturers might desire to produce pesticides under licensing arrangements with United States firms, the present tendency apparently is to develop such contacts primarily with West German and Swiss firms.

BELGIUM

(Based on report by C. E. Lilien, U. S. Embassy, Brussels)

Production

The Belgian chemical-pharmaceutical industry is engaged both in production of pest-control products and in compounding and packaging of domestic and imported basic ingredients. Production data are unavailable. There are at least seven firms engaged in manufacturing, compounding, or packaging of these products, about 10 or 15 percent of which are for household use.

Domestically available toxic ingredients for pesticide manufacture (some of which also are imported) are: Salts of dinitro ortho cresol, copper oxychloride, tetramethythiuram disulfide, wettable sulfur, organic-mercury salts, calcium arsenate, and lead arsenate.

Basic ingredients imported for production of finished pesticides, with countries of origin, are as follows:

Commodity	*Countries of origin*
Benzene hexachloride	France, Netherlands, United Kingdom, Denmark
Copper oxychloride	Germany, Switzerland, United Kingdom
DDT	Italy, Switzerland, United States
Lindane	France, Germany, Netherlands
MCPA (methyl chlorophenoxyacetic acid)	Denmark, France, Netherlands, United Kingdom
Organic mercury salts	France, Germany, Netherlands, Sweden, United Kingdom
Parathion	Denmark, Germany, United States
Sodium chlorate	Czechoslovakia, France, Germany
TCA (Trichloroacetic acid—a weed-killer)	France, Germany, United States
Tetramethylthiuram disulfide	Germany, Netherlands
Wettable sulfur	Germany, Switzerland, United Kingdom
2, 4–D	Denmark, France, Germany, Netherlands, United Kingdom, United States
2, 4, 5–T	Germany, United States

Consumption

Although figures are not available, it is believed that both household and agricultural consumption of pesticides is expanding.

Foreign Trade

Exports of pesticides in 1954 declined noticeably from those in the previous year, but imports were slightly above the 1953 figure. Since the Belgian industry imports many basic ingredients for compounding and packaging, this increase in imports may indicate that domestic sales in 1953 were high compared to previous years.

The Netherlands is the principal export market for Belgian pesticides, accounting for 30 to 40 percent in the past 2 years. Germany is the main source for imports, supplying between 30 and 40 percent. West German participation has increased in recent years and imports from the United States have decreased. This trend is believed to be

Table 27.—*Belgian Foreign Trade in Pesticides, 1953*

Commodity classification and country of origin or destination	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Copper sulfate, total	36, 700	14, 600
Disinfectants, fungicides, and insecticides and similar medicines, n. e. s., as well as all products serving this use (for retail sale):		
Tablet form:		
Containing DDT:		
Netherlands	40, 500	18, 260
Other	18, 900	10, 860
Total	59, 400	29, 120
Not containing DDT:		
Netherlands	77, 000	51, 900
United States	51, 900	36, 640
Other	151, 800	141, 000
Total	280, 700	229, 540
Other forms:		
Containing DDT:		
Netherlands	60, 300	11, 080
Other	146, 500	28, 440
Total	206, 800	39, 520
Not containing DDT:		
Germany, West	1, 867, 100	442, 280
Netherlands	925, 300	183, 080
Switzerland	495, 400	113, 240
United Kingdom	604, 100	118, 320
United States	152, 900	61, 200
Other	584, 700	129, 900
Total	4, 629, 500	1, 048, 020

Table 27.—*Belgian Foreign Trade in Pesticides, 1953*—Continued

Commodity classification and country of origin or destination	Quantity (pounds)	Value (U. S. dollars)
EXPORTS		
Copper sulfate:		
Brazil	415, 300	40, 766
Colombia	684, 600	62, 400
Egypt	3, 101, 500	315, 400
France	539, 000	49, 320
Germany, West	9, 186, 700	795, 000
Greece	2, 018, 900	183, 620
Hungary	6, 560, 000	579, 180
Jamaica	1, 320, 000	109, 020
Netherlands	2, 397, 500	223, 660
Spain	4, 387, 200	404, 660
Spanish Guinea	2, 187, 900	201, 360
U. S. S. R	4, 363, 000	396, 000
Total	37, 161, 600	3, 350, 386
Disinfectants, insecticides, fungicides, etc. (in small packages):		
Containing DDT	2, 600	2, 200
Other:		
Netherlands	14, 700	4, 580
Portugal	4, 400	1, 000
Belgian Congo	35, 000	17, 620
Other countries	5, 700	6, 040
Total	59, 800	29, 240
Other disinfectants, insecticides, fungicides, etc.:		
Containing DDT:		
Belgian Congo	7, 900	2, 880
Other countries	2, 900	560
Total	10, 800	3, 440
Other:		
Austria	65, 500	13, 460
Belgian Congo	1, 068, 300	178, 340
Algeria	106, 300	29, 080
Lebanon	26, 800	8, 460
Netherlands	1, 128, 000	240, 000
Other	601, 900	113, 760
Total	2, 996, 800	583, 100

Source: Belgian official statistics.

due to lower German prices, more liberal credit terms, and the increasing availability of items previously obtainable principally from the United States. However, the United States supplied 50 percent of all DDT–base products imported in 1954.

Equipment

Availability of equipment is not a limiting factor in the use of pesticides in Belgium.

Marketing and Distribution

Local manufacturers sell both to wholesalers and retailers. Imports are generally handled through agents.

Government Decrees and Regulations

Sale of pesticides is governed by the law of January 28, 1946, which requires that products for sale must be approved by the government testing station at Gambloux.

Prospective Developments and Trends

With little statistical information available regarding the Belgian pesticide industry, it is impossible to project future consumption and trends. The recent growth in use of these products and increased imports from Germany indicate that sales of Unites States pesticides, particularly of specialized commodities, might be expanded if competitive conditions were met.

DENMARK

(Based on report by J. B. McGrath, U. S. Embassy, Copenhagen)

Production

Local manufacture of pesticides is limited. For most requirements Denmark imports pest-control products and/or toxic ingredients and formulates or compounds the finished product. Compounding is the more important aspect of the industry, which is very competitive and is dominated by 7 or 8 large firms.

The most important pesticides manufactured in Denmark and the number of manufacturers are:

Parathion.—One firm, with annual output of 300 metric tons (100 percent). This output considerably exceeds local requirements and there is a lively export trade.

2,4–D.—One firm, with annual output of 50 to 100 tons (100 percent).

2,4,5–T.—The same firm which produces 2,4–D. Danish demand is small and annual output is only about 10 tons (100 percent).

MCP (methyl chlorophenoxyacetic acid).—Three firms. Total annual output varies from 600 to 900 metric tons (100 percent).

BHC.—Limited production.

Denmark lacks raw materials for manufacture of pesticides and, except for chlorine, caustic soda, and some orthocresol, depends almost entirely upon imported chemicals.

The trade estimates that domestic manufacture accounts for 15 to 20 percent of the volume of pesticides used. The greater percentage of imports consists of toxic ingredients, although some finished preparations are imported and packaged.

Consumption

An official publication of the Ministry of Agriculture estimated 1949 consumption of pesticides at 7,500 metric tons. Later official statistics are not available. Trade sources have furnished the following annual estimates of consumption (in metric tons):

Copper sulfate	2,000
DDT (100%)	50–75
Dinitro orthocresol	15
Lindane	15–20
Nicotine (95%)	10
Parathion (100%)	30–50
Methyl-parathion preparations (imported from Germany)	500–600
Petroleum oils	300–400
Pyrethrum (25% extract)	10–15
Sulfur	250–300
Sodium chlorate	600–1,000
Methyl chlorophenoxyacetic acid (MCP)	600

It is not possible to make reliable estimates of percentage use of pesticides by agriculture, public health, and household. Denmark is primarily an agricultural country and undoubtedly agriculture is the most important consumer of pesticides. Also, common household and public health pests are less numerous than in many other areas.

Agricultural consumption of pesticides is already at a very high level, reportedly higher than in most other European countries. Assuming current income level, trade sources anticipate only a small increase in consumption by 1960.

Foreign Trade

Import and export licenses are required but, except for the dollar area, are issued freely.

The United Kingdom has been the principal source of imports of pesticides, but in the last 2 or 3 years there has been a shift to West Germany, which is expected to soon be Denmark's principal supplier. The Netherlands and Switzerland also supply significant quantities. Direct imports from the United States are restricted by the import licensing program, but some imports from European countries may represent manufacture based on United States materials or under license to a United States firm.

Trade sources indicate that exports consist chiefly of parathion, 2,4–D, 2,4,5–T, and MCP. Parathion exports, estimated at 200 tons annually, are reportedly made to South America as well as the

Table 28.—*Danish Foreign Trade in Pesticides, 1953*

[Quantity in pounds; value in U. S. dollars]

Classification and principal countries of origin and destination	Imports		Exports	
	Quantity	Value	Quantity	Value
Fungicides:				
West Germany	15, 610	7, 395		
All other countries	23, 770	4, 645	440	725
Total	39, 380	12, 040	440	725
Tree sprays, total	11, 360	1, 300	35, 400	1, 885
Nicotine, total	7, 900	1, 455		
Sprays for agriculture and horticulture:				
Belgium and Luxembourg	66, 400	9, 570	404, 140	98, 745
Germany (both East and West)	484, 400	155, 005		
Netherlands	97, 020	39, 730	199, 100	96, 425
Sweden	2, 640	1, 710	277, 860	38, 765
United Kingdom	1, 094, 200	175, 740	964, 700	204, 885
All other countries	170, 300	88, 190	508, 400	147, 270
Total	1, 915, 100	469, 945	2, 354, 200	586, 090
Other insecticides and disinfectants:				
Germany, West	36, 960	42, 920	1, 760	9, 005
Sweden	7, 260	5, 945	114, 840	86, 130
United Kingdom	118, 580	103, 110	151, 140	44, 660
United States	103, 180	40, 165	220	145
All other countries	48, 400	27, 680	169, 400	84, 230
Total	314, 380	219, 820	437, 360	224, 170

Source: Danish official statistics.

Middle East. Exports of 2,4–D vary greatly, but in recent years are believed to be about 50 to 75 tons (100% basis); 2,4,5–T exports probably do not amount to more than 10 tons a year; 200 to 300 tons (100% basis) of MCP are exported annually. These three products (all weedkillers) are exported to Western European, particularly Scandinavian, countries.

Equipment

In early postwar years a shortage of spraying and dusting equipment led to considerable use of stations where farmers could rent machinery. Over 200 stations of this kind still exist, but trade sources state that consumption of pest-control products is no longer limited by a shortage of equipment. Three airplanes also are available for spraying and dusting in Denmark.

Marketing and Distribution

Most pesticides are imported on an agency and/or licensing basis. The 6 or 7 large Danish distributing firms have arrangements

with important United States, German, British, Dutch, and Swiss manufacturers. Some pesticides are imported in finished form and others are formulated in Denmark under an arrangement with the manufacturer. The terms of sale vary considerably but, in general, are on direct purchase against documents, although 30 to 60 days credit is not unusual. United States sellers offer the least flexible terms of sale.

Distribution of agricultural and household pesticides is made by importer-formulators, who also act as wholesalers. These firms, in conjunction with their foreign suppliers, prepare and distribute voluminous leaflets and pamphlets to retailers and consumers and also advertise in trade journals.

There is no distribution of pesticides by international or local government agencies, although the latter are alert to the need to assist consumers and to encourage and control the use of pesticides.

Government Decrees and Regulations

A law of November 1, 1954, designed to restrict use of pesticides harmful to humans and animals, requires that every pest-control product be submitted for testing. On the basis of the test, each is classified according to potential danger. Products classified as "X" (most harmful) can be sold by a retailer only on the basis of a permit issued to the consumer by the Ministry of Agriculture; products classified "A" and "B" can be sold on the basis of a permit issued to the consumer by local police authorities.

Governmental agencies under the general direction of the Ministry of Agriculture interest themselves in pesticides. The Kemikaliakontrollen periodically tests samples of prepared products to ensure that they contain the kinds and amounts of chemicals specified. The cost of this service is met by imposing a tax of 1.25 percent on wholesale sales of each product. The Statens Foreøgsvirksomhed i Plantskultur tests the efficiency of commodities submitted to it for approval. Submission to this agency is not obligatory but, as a practical matter, most products are submitted. This organization publishes annually two lists of approved products and consumers are usually reluctant to purchase commodities not appearing on these lists. (Copies of the 1954 lists, "Approved Preparations for Use Against Plant Diseases and Pests" and "Approved Weed Killing Preparations," are on file in the Chemical and Rubber Division.)

Prospective Development and Trends

Trade sources indicate there is little opportunity for investment of United States capital or technical knowledge in the Danish pesticide industry. Danish firms, alert to manufacturing opportunities, in

recent years have produced limited quantities of DDT, lindane, and ferbam with little success. The consensus of the trade is that it is more economical for Denmark to rely on imports of toxic materials and more or less limit activity to formulating. Although the one producer of parathion appears to be basing production largely on the export market, the trade considers this an unusual case.

Most large Danish firms are affiliated in some way with European producers and European products dominate the market. However, several new United States products are having success and, if the dollar position further eases, imports may increase. The field of new product offers the greatest opportunity for increased participation of United States firms in the Danish market.

EIRE (IRELAND)

(Based on report by T. J. Bannon, U. S. Embassy, Dublin)

Production

Pesticide production in Eire is on a limited scale, the industry being chiefly concerned with compounding and packaging imported raw materials. There are approximately 10 companies engaged in this field. Almost no raw materials used in the manufacture of pest-control products are available. Official estimates of output are not available; however, according to the Irish *Trade Journal* and *Statistical Bulletin*, March 1954, value of production in 1951 and 1952 was as follows:

	1951	*1952*
Sheep and cattle dips	$48, 500	$58, 675
Insecticides	129, 250	151, 250
Weedkillers	23, 450	34, 910

Consumption

Official statistics on consumption are not available; use probably equals production plus imports.

It is assumed that by 1960 the demand for cattle and sheep dips, selective weedkillers, and seed dressings will have increased considerably, due to a growing awareness on the part of farmers of benefits to be derived from their use. A recent newspaper article estimated annual loss to the cattle industry through damages to carcasses and hides by the warble fly as around $8.5 million. Only about 10 percent of seeds are treated and the use of weedkillers is in its infancy. These facts indicate the potential need for various pest-control products.

Foreign Trade

Imports have been on an upward trend in recent years which is likely to continue for some time. The United Kingdom is the principal source of supply, but it is understood that Germany and the Netherlands are now entering the Irish market.

Small shipments of fungicides are exported from Eire, but no great development in this trade is anticipated.

Equipment

Dusting equipment is not available, but this lack is not a limiting factor in use of pesticides. Spraying equipment, both low- and high-volume power sprayers operated by contracting firms as well as by individual owners, is adequate to meet requirements. Use of equipment undoubtedly will expand as consumption of pesticides increases.

Marketing and Distribution

Distribution of pesticides is effected through company representatives or traveling salesmen who sell to wholesale merchants and retail dealers. Government agencies are not concerned with the marketing of these products.

Local purchases are on a credit basis; those from the United Kingdom are paid for 30 days after receipt of invoice. European sales are usually against documents, and irrevocable letters of credit are ordinarily required for purchases from the United States.

Principal advertising media are newspapers and farm journals. Showcards for counter- and window-display purposes also are used. Although Eire has an unusually large movie-going population, advertising through this medium has not been used.

Government Decrees and Regulations

As a protective measure, in November 1954 the Irish Government imposed a tariff of 50 percent ad valorem (full and 33⅓ percent preferential) on imports of disinfectants, insecticides, fungicides, and weedkillers. As a result, it is understood that 2 or 3 large British companies who now compound and package imported materials in Ireland may establish plants for manufacture of the basic materials from which pesticides are compounded.

Prospective Developments and Trends

The Irish Government is very much interested in attracting United States capital for investment in new industries. However, it must be

Table 29.—*Imports of Pesticides into Eire, 1953 and 1954*

[Quantity in pounds; value in U. S. dollars]

Commodity classification	1953				1954			
	Total		From the United Kingdom		Total		From the United Kingdom	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Disinfectants, including cattle and sheep dips	1, 403, 808	281, 375	1, 398, 208	278, 975	1, 004, 640	313, 000	982, 976	308, 000
Insecticides	738, 976	177, 480	664, 720	155, 400	942, 576	186, 300	538, 944	165, 800
Weedkillers	1, 406, 720	184, 800	[1] 280, 528	115, 560	1, 450, 736	319, 000	722, 400	263, 900
Other	448, 786	171, 364	433, 328	159, 200	254, 792	99, 600	241, 696	94, 620
Total	3, 998, 290	815, 019	2, 776, 784	709, 135	3, 652, 744	917, 900	2, 485, 616	832, 120

[1] In 1953, West Germany was the country of origin for 427,840 pounds ($33,320) of weedkillers and France for 604,128 pounds ($24,390).

Source: Central Statistics Office (Eire).

borne in mind that virtually no raw materials are available locally and that the Irish market is limited by the size of the country and a small population. Possibilities as a production and distribution base exist for a United States company interested in entering the small Irish market and expanding into Continental Europe.

Except for new products not available elsewhere, prospects for increased participation of United States pesticides in the Irish market are not very encouraging, principally because freight rates place them in a noncompetitive category. While the quality of all United States pesticides is unquestioned, in some instances freight rates per ton are stated to be higher than the combined cost and shipping charges of a comparable European product. To improve their market position in Ireland, United States pesticides must be able to compete with the lower priced British products which have the additional benefit of a preferential customs duty and lower freight charges.

FINLAND

(Based on report by E. Kaukokallio, U. S. Embassy, Helsinki)

Production

The domestic pesticide industry supplies most of the DDT, zinc arsenate, and warfarin used in Finland. Numerous imported compounds under trade names are sold in the Finnish market, but compounding from imported and domestic basic ingredients and semifinished products is more extensive. There are more than 20 importers, distributors, and compounders of pest-control products, 5 of which are of major importance. Official statistics on production of pesticides are not available.

Consumption

With introduction of new pest-control products, such as DDT and BHC, the use of pesticides for all purposes has increased greatly. Consumption is promoted by dissemination of advice on correct selection and application of pesticides by principal manufacturers, compounders and importers, and by farm and household advisory organizations.

A total of 127 pesticide products was sold in Finland in 1953. Compared with previous years, DDT lost ground to the thiophosphates and BHC for agricultural purposes. Powdered arsenic continues to have a steady demand from agriculture. For household and storage pest control, DDT ranked first in powders and sprays in 1953, but when fumigants and aerosols are included, the largest area was treated

Table 30.—*Finnish Sales of Three Principal Toxic Substances for Pest Control, 1953*

[Pounds]

Toxic substance	For agricultural sprays and dusts	Household and storage sprays and dusts
DDT:		
100 percent	10, 000	15, 780
As 6 percent powder	167, 140	263, 500
BHC:		
100 percent	1, 386	110
As 0.65 percent powder	21, 390	16, 980
Thiophosphates:		
100 percent	6, 160	----------
As 1.5 percent powder	405, 050	----------

Source: Finnish Government Bureau of Plant Protection.

with BHC (including lindane). Among rodent-control products, warfarin ranks first in use. Malathion is currently being subjected to official tests preparatory to possible introduction on the Finnish market.

It appears that use of pesticides in Finland will definitely increase in the next few years and that by 1960 sales probably will be at least 50 percent above those in 1954.

Foreign Trade

All imports into Finland are subject to license. Principal suppliers of pesticides are the United Kingdom, West Germany, the Netherlands, and Denmark. Disinfectants and plant-protection materials are specifically included in Finland's bilateral trade agreements with these countries. A shortage of dollar exchange has greatly limited purchases from the United States (see table 31). United States exports of pesticides to Finland are unimportant, amounting to only $30,000 in 1954 and $48,000 in 1955.

Equipment

Certain types of spraying and dusting equipment are supplied by domestic manufacturers, but models and prices are not always satisfactory. A shortage exists in engine-driven sprayers for orchards, tractor-driven low-volume sprayers, knapsack sprayers, and fan-driven dusters, because currency restrictions limit importation. Projects are under way for domestic manufacture of valves for aerosol dispensers.

Marketing and Distribution

Pesticides are imported and sold through usual trade channels. Compounders purchase basic ingredients and semifinished products direct from foreign suppliers or through local importers and agents.

Table 31.—*Finnish Imports of Pesticides, 1953*

Import classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Disinfecting preparations, n.e.s., fungicidal, insecticidal and other similar preparations:		
Denmark	55, 000	27, 846
France	35, 200	38, 930
Germany, West	316, 800	109, 035
Netherlands	187, 000	19, 745
United Kingdom	272, 800	92, 742
Other countries	49, 200	16, 592
Total	915, 000	304, 890

Source: Finnish official statistics.

Imported finished pesticides are sold through manufacturers' local representatives.

Major importers, manufacturers, and compounders publicize their products by means of descriptive pamphlets, leaflets, and newspaper and trade journal advertising, in the Finnish and Swedish languages. The Plant Protection Bureau of the Ministry of Agriculture exercises control over advertising of pesticides to prevent unfounded or misleading statements.

Government Decrees and Regulations

Production and sale of pesticides are governed by the Plant Protection Law and implementing decrees. Before release to the market, all pesticides are subject to inspection by the Plant Protection Bureau of the Ministry of Agriculture. Permission for sale of imported products may be given if they have been previously known in Finland and are covered by foreign inspection certificates.

Prospective Developments and Trends

Apparently no opportunity exists for investment of United States capital and technical assistance in the manufacture of Finnish pesticides. The greatest market for United States pest-control products is in the field of new pesticides, some of which are not presently manufactured in Europe.

FRANCE

(Based on report by Lucienne M. Piquemal, U. S. Embassy, Paris)

Production

About 100 factories in France manufacture pest-control products; 30 are equipped with modern installations. Production capacity is considered sufficient to satisfy requirements.

Copper sulfate, produced by 25 firms, is the oldest and most popular product, but output in 1953 (39,930 metric tons) was almost 30 percent below 1952 production. In recent years dithane and captan have given good results in place of copper sulfate for some applications. Until 1952, dithane was imported from the United States but it is now produced in France under the name of zineb. It costs less than copper sulfate since copper must be imported at relatively high cost.

Twenty factories, 10 of which are very large, make synthetic organic pesticides. Total 1953 value of production was estimated at 4 billion francs (350 francs equal 1 dollar). One factory, with annual capacity of 1,500 to 2,000 metric tons, produces DDT; 7 factories manufacture BHC and lindane, with annual capacity of 3,500 tons technical BHC (13 percent); 3 factories make parathion and tetraethyl pyrophosphate. Official production statistics are not available; however, the Chambre Syndicale de la Phytopharmacie, in cooperation with a group of important producers, estimates production of major pesticides in 1952 as follows (in metric tons):

Copper sulfate	55,000	Petroleum oils	1,000
Sulfur (agricultural)	60,000	DDT (100%)	1,000
Arsenates (calcium, lead, and sodium)	5,000	BHC	2,000–2,500
		2,4–D (acid)	500

Other pesticide materials produced in France include carbon bisulfide, carbon tetrachloride, methyl bromide, mercuric disinfectants, ortho-oxoquinoline sulfate, dithiocarbamate fungicides, dinitro-ortho-cresol compounds, MCPA (2-methyl-chlorophenoxyacetic acid—a weedkiller), alphanaphthyl thiourea (ANTU—a rodenticide), thallium sulfate, zinc phosphide, warfarin, sodium cyanide, and chloropicrin. Principal imported toxic ingredients for pesticides are chlordane, aldrin, dieldrin, allethrin, toxaphene, Diazinon, captan, methoxychlor, and 2,4,5–T.

Six major firms manufacture household pesticides which are sold throughout France under well-known trademarks. Raw materials are obtained from French chemical companies. The most popular household insecticides are compounded from BHC, lindane, chlordane, naphthalene, paradichlorobenzene, pyrethrum, and DDT. Annual value of French production of household insecticides has been estimated at 1.5 billion French francs (approximately $4.3 million). Domestic production is claimed to be sufficient to meet demand. The quality of French household insecticides is said to be good and to compare favorably with products manufactured in other countries. Quality of aerosols has improved in recent years and sales are increasing. French production of aerosol bombs is estimated at 2.5 to 3 million units per year. New products include a refillable aerosol, an atomizer, a box of matches for repelling insects, a fogger, and an electric lamp to disperse lindane powder.

Consumption

Annual consumption of agricultural pesticides varies because of changing weather conditions and degrees of infestation, but is generally estimated as follows (in metric tons):

Copper sulfate	50, 000
Sulfur (agricultural)	40, 000–60, 000
Arsenates (calcium, sodium, and lead)	5, 000– 6, 000
Alkaloid compounds (nicotine, rotenone, pyrethrum)	5, 000– 6, 000
Petroleum oils	1, 000– 1, 500
DDT (100%)	1, 000– 1, 500
BHC and lindane	2, 000– 2, 500
2,4-D (acid)	500

A general increase in consumption of agricultural pesticides is foreseen, due to continued efforts of the French Government and private interests to modernize French agriculture, and to the development of more scientific agricultural methods under the sponsorship of the Ministry of Agriculture.

The annual retail value of household insecticides marketed has been estimated at 3 to 4 billion francs. For a country with 43 million inhabitants, this may be considered small; on the other hand, the temperate climate contributes to keeping down flies and mosquitoes. General improvement in household hygiene is also responsible for a decrease of household insects.

Foreign Trade

Import licenses are granted for pesticides meeting the following conditions:

(a) When originating in an OEEC (Organization for European Economic Cooperation) country and appearing on the list of "liberated products";

(b) When originating in countries with which France has signed a trade agreement (within the limit of allotments);

(c) When originating in other countries, when the product is not manufactured in France or is produced only at considerable outlay of foreign exchange for raw materials, or cannot be purchased from countries in categories (a) and (b) above;

(d) When payment for such imports is effected by compensation transactions.

The following credits, under existing trade agreements, were allotted in 1953 for the importation of pesticides (excluding raw materials):

	(*Thousands of French francs*)
Germany	30, 000
Belgium-Luxembourg	5, 600
Netherlands	18, 000
Switzerland	8, 000
United Kingdom	20, 000

Below is a list of organic pesticides imported from the United States in 1953 and the first 9 months of 1954 (excluding compensation transactions), with corresponding value of dollar exchange granted by the French Government.

	1953	1954 (Jan.–Sept.)
Allethrin	None	$43, 500
Chlordane	$7, 100	16, 650
Dieldrin	12, 600	18, 100
Aldrin	48, 200	89, 450
Toxaphene	5, 550	20, 750
DD (dichloropropene and dichloropropane—a soil fumigant)	34, 650	188, 450

Household insecticides are not imported. Table 32 shows imports of agricultural pesticides into France in 1953 and 1954.

France ships copper sulfate, sulfur, and arsenates to its overseas territories and certain countries in the Middle East, South America, and Europe. Furthermore, despite competition, France is slowly developing a foreign market for organic pesticides, particularly with countries having limited supplies of dollars and which prefer to purchase where payment can be made in francs, even at a higher price. Exports of household insecticides are only to French overseas territories and do not exceed 1,000 metric tons a year. Table 33 gives French exports of agricultural pesticides in 1953 and 1954.

Table 32.—*French Imports of Pesticides, 1953 and 1954*

[Quantity in pounds; value in U. S. dollars]

Import classification and principal countries of origin	1953		1954	
	Quantity	Value	Quantity	Value
Disinfectants, insecticides and similar preparations:				
Germany, West	411, 158	127, 980	No country breakdown available	
Switzerland	437, 834	134, 641		
United Kingdom	76, 279	48, 578		
United States	588, 187	209, 331		
All other countries	115, 301	33, 414		
Total	1, 628, 758	553, 944	1, 672, 630	533, 163
Preparations for agriculture and horticulture, total	24, 251	5, 107	60, 627	24, 418

Source: French official statistics.

Equipment

France manufactures all the various types of spraying and dusting equipment required for agricultural purposes. In 1953, 34 percent of production was exported to overseas territories and 10 percent to foreign countires. It is claimed that French equipment is high in quality and that prices are competitive with those from other countries.

Table 33.—*French Exports of Pesticides, 1953 and 1954*

[Quantity in pounds; value in U. S. dollars]

Export classification and principal countries of destination	1953		1954	
	Quantity	Value	Quantity	Value
Disinfectants, insecticides and similar preparations:				
Algeria	10, 438, 120	1, 662, 054		
Belgium and Luxembourg	353, 397	119, 715		
Brazil	571, 432	312, 220		
Cameroon	487, 437	116, 606		
Denmark	115, 301	71, 403		
French East Africa	3, 625, 685	455, 912		
French Equatorial Africa	284, 614	66, 100	Country breakdown not available	
French Morocco	2, 010, 816	432, 117		
Italy	786, 601	50, 303		
Madagascar	4, 795, 005	677, 243		
Martinique	198, 194	67, 753		
New Zealand	714, 511	57, 803		
Switzerland	277, 780	112, 848		
Tunisia	1, 277, 345	225, 321		
Turkey	1, 406, 976	129, 369		
Uruguay	214, 287	84, 552		
All other countries	4, 733, 055	698, 471		
Total	32, 290, 556	5, 339, 811	31, 806, 426	6, 191, 703
Preparations for agriculture and horticulture:				
Algeria	550, 268	86, 484		
Brazil	71, 429	20, 981		
French East Africa	37, 919	9, 846	Country breakdown not available	
French Morocco	314, 376	59, 607		
Italy	18, 078	9, 199		
Madagascar	62, 390	14, 996		
Tunisia	155, 204	8, 990		
All other countries	109, 348	32, 753		
Total	1, 319, 012	242, 855	206, 351	68, 144

Source: French official statistics.

In 1953 France produced 104,611 spraying and dusting units of all kinds, having a total weight of 2,180 metric tons, and imported only 49 tons of such equipment, including 8 tons from the United States.

There are a few manufacturers of small sprayers for household insecticides. Other dispensers for these products are designed and manufactured at compounding plants.

Marketing and Distribution

Methods of distribution for agricultural pesticides vary according to producers and importers. Large companies, in general, have agencies in the principal towns to supply wholesalers, agricultural cooperatives, and retailers. There are 1,500 to 2,000 cooperatives which it is claimed distribute 50 percent of pest-control products consumed by French farmers. Smaller manufacturers employ sales

agents who usually also handle fertilizers and general farming supplies.

For distribution of household insecticides, large firms generally have agencies in the more important French cities. Others use wholesalers' distributing channels or have their own traveling salesmen. Wholesalers generally handle household insecticides in conjunction with cleaning products. Various retail outlets for household insecticides are drug stores, pharmacies, grocery stores, department stores, and chain stores.

French prices for pesticides are established by manufacturers except for copper sulfate and sulfur, which are still under government control. Distribution costs generally represent about 35 percent of retail price. General French trade practices apply to the pesticide industry—direct purchase payable by drafts at 30 to 60 days.

Advantageous payment arrangements are allowed to customers who place orders for household insecticides during the winter months. Payment for these orders may be postponed until May or June and manufacturers grant discounts which may run as high as 5 percent for out-of-season orders. New packing techniques enable products to retain their toxic qualities, even though kept in stock for several months.

The Ministry of Agriculture and international organizations do not control distribution of pesticides; this function is left to private concerns. For experimental purposes, or when upon rare occasions it becomes urgent to fight a particular pest in a given area, the Ministry of Agriculture may appoint its departmental agents to supervise control methods. When a government emergency program is involved, the pesticides distributed are either sold at very low prices or donated.

Advertising of pesticides is strictly prohibited until sale of the product is authorized by the Ministry of Agriculture. Issuance of the regular permit ("homologation") sometimes takes several weeks, but a termporary sales permit may be obtained with relatively little delay.

Trade circles recommend that manufacturers and importers of agricultural pesticides popularize their products by publication of pertinent information in French trade journals. Among the major scientific journals specializing in pesticides are *Phytoma*, published by the Chambre Syndicale de la Phytopharmacie and sponsored by the Ministry of Agriculture; *La Defense des Vegetaux*, published by the Ligue Nationale de Lutte contres les Ennemis des Cultures (National League for the Fight Against Agricultural Pests); and the weekly bulletin of the Ministry of Agriculture. The Ministry of Agriculture has published a recent survey of agricultural newspapers, a copy of which is on file in the Chemical and Rubber Division.

Agricultural fairs afford excellent advertising opportunities. Certain important producers of agricultural pesticides devote substantial

funds to participating in local fairs. Some have equipped trucks for advertising their products which travel from fair to fair.

All types of advertising media are used for household insecticides: Motion pictures, newspapers, trade journals, women's magazines, posters, etc. Manufacturers make generous distribution of advertising materials, such as small posters, display boxes, and gifts for children (caps, glasses, blotters, cards, and the like).

Government Decrees and Regulations

Legislation governing trade in pesticides is contained in "Regime des Substances Veneneuses et Toxiques" (Legislation on Poisonous and Toxic Substances), summarized below:

(a) Pesticides cannot be sold in France without an official permit issued by the Ministry of Agriculture and known as "homologation." The request for such permit is filed with the Vegetable Protection Bureau at the Ministry of Agriculture. Applications are submitted either by the manufacturer or by the importer who must furnish all pertinent data, together with samples of the products. Commodities which have been granted this official permit are registered on official lists kept by the Ministry of Agriculture.

(b) For transportation purposes, pesticides have been classified into three categories: (1) Toxic; (2) Narcotic; (3) Dangerous. The decree of November 19, 1948 (on file in the Chemical and Rubber Division) has codified this legislation.

Household insecticides are under the same general rules as other pesticides. (A publication outlining government regulations applicable to these products is on file in the Chemical and Rubber Division.)

Prospective Developments and Trends

Trade sources indicate that United States pesticides (both agricultural and household) enjoy an excellent reputation in France, and that, although domestic production is largely able to meet requirements, French users are interested in procuring United States pesticides, particularly new or specialized products. Prices for United States pesticides are competitive and sometimes even lower than for domestic products, despite the French import tariff of 25 percent. The principal deterrent to greater imports from the United States is lack of dollar exchange. In 1953, for example, only $160,000 was allocated for imports of United States pesticides. Annual requests for import licenses exceed the amount of dollars allocated, and imports from the United States have been more or less limited to experimental shipments for testing under French field conditions.

In recent years, the French pesticides industry has to some extent developed ties with United States producers, either through establish-

ment of plants in France by United States firms or through licensing arrangements. It is probable that increased future participation of United States pesticides (both agricultural and household) in the French market lies along these lines. Establishment of a United States factory in France or a licensing arrangement between a United States and a French firm requires prior approval of the French Government. In general, that approval is given when the proposal will serve to reduce the amount of foreign exchange which otherwise would be required, or where resulting activities would increase France's export trade and thus provide additional foreign currencies.

WEST GERMANY

(Based on report by J. C. Leary and L. Salzer, U. S. Consulate General, Dusseldorf)

Production

West Germany is one of the world's leading producers of all types of pesticides. Detailed information as to production of various commodities is unobtainable; the only official data are the following figures supplied by the Federal Statistical Office, Wiesbaden:

1953 Production of Seed Dressings, Plant-Protection and Pest-Control Agents

	(*Metric tons*)
Inorganic	22, 003
Organic	23, 768
Other	7, 965
Total	53, 736

Although the above tabulation gives no information regarding toxic ingredients, some idea of the relative importance of various pest-control products may be obtained from the data under "Consumption" below.

Almost 200 firms are engaged in the production of pesticides in West Germany. The largest is Farbenfabriken-Bayer AG., Leverkusen, but there are many others of importance, including Farbwerke Hoechst, Frankfurt/Main; Schering AG., Muellerstrasse 170–172, Berlin; and E. Merck, Darmstadt.

Certain raw materials such as crude sulfur (most of which comes from the United States) and copper are imported. However, the growing importance of, and preference for, synthetic pesticides has made West Germany practically self-sufficient in pest-control products.

Consumption

Official statistics on consumption of pesticides in West Germany are not available, although it is estimated that domestic sales for agricultural purposes amount to about $24 million per year, about 20 percent of which is for control of pests in vineyards.

An article entitled "The Size and Importance of Chemical Plant Protection Measures," by Herr H. Drees, appearing in a trade paper (*Nachrichtenblatt des Deutschen Pflanzenschutzdienates*) in July 1954, covered the fiscal year 1952–53 (April 1 to March 31). This article outlines the major agricultural pest-control measures taken during that period, which probably accounted for two-thirds of consumption of pesticides. A summary of the article follows.

General plant-protection and pest-control measures carried out by West German agriculture in 1952–53 cost approximately $14,688,000, broken down as follows: Insecticides, $4,752,000; fungicides, $5,952,000; herbicides, $2,640,000; ovicides, $1,344,000.

Crop dustings with insecticides in 3 major sectors cost about $4,550,000 (70 percent on root vegetables, 25 percent on viticulture, and 5 percent on oleaginous plants) and accounted for about 92 percent of total consumption of insecticides. Measures against the Colorado beetle accounted for $3,360,000, with about 96 percent of potato fields being treated. Insecticides employed were calcium arsenate (about 1,700 metric tons, of which 950 came from 1952 production and 750 from stocks), and synthetic organic compounds (DDT and BHC, a total of about 4,800 tons). Oleaginous plants were treated with 800 tons of synthetic organic dusting agents at a cost of $215,000. For protection of vineyards against the grape-berry moth, organic phosphatic insecticides and DDT in about a 60:40 ratio were used at a cost of $1,175,000. About 1,000 tons of 10 percent DDT were used for this purpose.

Around 100 million liters of winter spraying solutions (tar oil and dinitrocresol) were used on 20 million apple and pear trees (about one-fourth of total trees).

For seed treatment about 920 tons of mercury-base fungicides were consumed at a cost of slightly over $1 million. About $4,500,000 was spent on copper-base fungicides, as follows: On root crops, $1,920,000; for vineyards, $1,630,000; on orchards, $96,000; and for miscellaneous purposes, $850,000. Potatoes were treated with almost 2,000 metric tons of copper-base agents against late blight. For protection of vineyards, 4,500 metric tons of copper oxychloride (15–18 percent copper content) were used, and an additional 150 metric tons (45–50 percent copper content) was used against scab on fruit trees. About 3,000 metric tons of sulfur-base fungicides were applied on vineyards.

It is estimated that 4,500,000 acres of grain are overgrown with weeds. In 1952–53 around 1,375,000 acres of weed-infested grain

were treated with organic weedkillers at a cost of $2,640,000. Other herbicides, such as calcium cyanamide and dinitrocresol are used, but statistics on consumption are not available.

Nonagricultural use of pesticides (household, protection of stored products, rat and fly control, etc.) account for not more than 3 percent of total consumption.

According to officials of the Federal Ministry for Food, Agriculture, and Forestry, an annual increase in consumption of pesticides of $2,500,000 to $3,500,000 will take place in the next 5 years.

Foreign Trade

German imports of pesticides are very small and are not expected to increase significantly. (See table 34.)

Table 34.—*West German Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Agents for disinfection, pest control, and the like, including weedkillers and fungicides:		
Belgium	45, 856	5, 238
Denmark	14, 550	8, 572
France	68, 343	26, 905
Netherlands	76, 940	22, 858
Sweden	145, 724	27, 381
Switzerland	184, 305	146, 670
United Kingdom	30, 203	28, 810
United States	101, 632	47, 620
Reimports [1]	159, 613	48, 810
Total	827, 166	362, 864

[1] Official trade statistics do not define "reimports."

Source: Official trade statistics of West Germany.

West Germany, a highly industrialized country and a traditional producer of pesticides, is important in the world market for these commodities, with exports totaling around 30 percent of production. Considerable quantities of pesticides are exported to neighboring European countries, but Latin America, particularly Central America, is by far the most important market and purchased more than 40 percent of West German exports in 1953. New Zealand, China, Japan, and countries in southern Africa are other important customers (see table 35). The overall total of pesticides exports is increasing and this trend is expected to continue, but no important shifts in the distribution pattern of exports are likely. Increased selling efforts are planned, particularly in South and Central America.

Major competition in foreign markets for pesticides is from the United States and Great Britain, since products from these countries compare favorably in price and quality to those produced in West

Germany. United States competition is particularly severe in Latin America, where shipping charges are an important factor.

Equipment

Germany is an important producer of spraying and dusting equipment. In 1953, there were 350,000 portable and 86,000 mobile spraying and dusting units in the country. West Germany exports plant-protection machinery, and imports are negligible. In general, United States machinery is more expensive than similar models produced in Germany, but there is often a market for equipment differing from domestically produced types.

Marketing and Distribution

The normal flow for distribution of pesticides is from factory to wholesaler (or central cooperative) to retailer (or local cooperative) to farmer. Government purchases are limited to special projects.

Government Decrees and Regulations

There are no government controls on production of pesticides. Distribution controls are confined to sales regulations for materials poisonous to man and animals. The existing (1940) Police Ordinance on the Marketing of Poisonous Plant Protection Media was amended on July 22, 1954, by addition of phosphatic insecticides to the list of items covered by sales regulations.

Of importance is the certifying procedure of the Biologische Bundesanstalt fuer Land- und Forstwirtschaft (Federal Biological Institute for Agriculture and Forestry), Breunsweig-Gliesmarode. In contrast to fertilizer and seed marketing, for which certification is compulsory, testing and certification of pesticides is a voluntary procedure to which practically all producers submit. The system functions so well that no producer would find a market for a new pesticide unless it had the official recognition of the Biologische Bundesanstalt.

Prospective Developments and Trends

Opportunities for use of United States technical knowledge in West Germany lie principally in the licensing of German firms to manufacture United States pesticides. West German producers follow developments closely and are alert to new pesticides which are promising in effectiveness and economic possibilities. There are already a large number of licensing and cross-licensing agreements between manufacturers in the two countries.

Table 35.—*West German Exports of Pesticides, 1954*

Commodity classification and principal countries of destination	Quantity (pounds)	Value (U. S. dollars)
Agents for disinfection and the like, including weed-killers and fungicides:		
Algeria	110, 450	44, 287
Argentina	862, 440	268, 815
Australia	213, 405	80, 002
Austria	951, 505	330, 007
Belgium	2, 285, 509	597, 869
Belgian Congo	1, 268, 086	217, 861
Brazil	1, 881, 626	416, 675
Bulgaria	41, 226	28, 096
Canada	159, 613	32, 382
Ceylon	1, 120, 157	43, 334
Chile	327, 824	114, 764
China	2, 343, 049	474, 533
Colombia	1, 679, 905	396, 436
Costa Rica	99, 207	26, 905
Denmark	2, 413, 376	388, 579
Ecuador	204, 587	122, 860
Egypt	434, 086	38, 572
Finland	98, 986	79, 763
Formosa (Taiwan)	54, 895	79, 525
France	733, 250	284, 530
French Morocco	372, 577	61, 906
Greece	222, 444	98, 097
Guatemala	528, 002	75, 240
Hong Kong	18, 519	31, 191
Indonesia	932, 766	208, 337
Iran	103, 837	27, 143
Italy	1, 549, 834	540, 963
Japan	121, 032	123, 574
Lebanon	87, 302	48, 334
Luxembourg	91, 711	31, 905
Mexico	1, 385, 371	818, 826
Netherlands	7, 134, 086	968, 115
New Zealand	182, 761	113, 336
Nicaragua	1, 564, 605	149, 527
Norway	287, 039	114, 288
Pakistan	379, 412	32, 620
Peru	436, 070	252, 624
Philippine Republic	153, 881	45, 715
Poland	400, 135	60, 716
Portugal	491, 846	105, 716
Rumania	173, 282	145, 479
Saar	84, 877	35, 477
Salvador	2, 789, 260	208, 576
Saudi Arabia	128, 308	40, 715
Sweden	1, 812, 622	379, 055
Switzerland	877, 210	233, 576
Syria	110, 450	33, 810
Thailand	217, 153	157, 146
Turkey	429, 236	349, 055
Union of South Africa	273, 811	89, 526
United Kingdom	160, 054	42, 144
Uruguay	406, 308	92, 621
Venezuela	373, 018	79, 049
Yugoslavia	273, 811	98, 335
All other countries [1]	1, 166, 621	277, 863
Total	43, 092, 433	10, 236, 395

[1] Those countries to which less than $25,000 worth were shipped.

Source: West German official trade statistics.

The high standard and volume of German production, customary preference for German-manufactured products, well-established domestic trade channels, and freight and other costs involved preclude increased sales of United States pesticides in West Germany. It is unlikely that these factors can be overcome and that United States exporters of pest-control products can improve their competitive position in Germany.

GREECE

(Based on report by P. Hudson and F. Triandaphyllides, U. S. Embassy, Athens)

Production

The Chemical Products and Fertilizer Co. is the only Greek firm producing pesticides. Before World War II most Greek pesticides were based on copper or arsenic compounds. With commercial development of the new synthetic organic insecticides, the above company began manufacturing formulations based on BHC and DDT.

According to the firm, formulation of various trademarked pesticides in Greece in recent years has been composed of the toxic ingredients shown in table 36.

Table 36.—*Greek Production of Pesticides and Toxic Ingredient Used*

Toxic ingredient	Production (pounds)			
	1951	1952	1953	1954 (Jan.–June)
BHC 3 percent	53, 647	54, 965	77, 820	63, 030
BHC 1 percent	165, 484	197, 483	232, 550	80, 850
BHC 10 percent	1, 023	265	870	290
Lindane	----------	----------	26, 400	24, 210
Ferrous sulfate (99 percent)	101, 420	420, 200	288, 200	233, 200
Copper sulfate	2, 640	306, 460	40, 550	133, 980
Nicotine sulfate (45 percent)	25, 210	3, 060	21, 680	11, 925
Sulfur (40 percent), copper sulfate (8 percent)	310, 880	419, 320	354, 450	555, 830
Pyrethrum (0.2 percent), DDT (4 percent)	72, 060	113, 520	101, 860	44, 000
Sulfur	135, 540	178, 200	248, 050	245, 410

Source: The Greek Company of Chemical Products and Fertilizers.

Pesticides are formulated largely from imported raw materials, but BHC is produced from locally manufactured chlorine and imported benzene. Copper oxychloride is made from scrap copper and hydrochloric acid. Sulfuric acid also is locally manufactured.

Consumption

Official statistics on consumption are not available, but it closely approximates production plus imports. The government imports through the Agricultural Bank of Greece, and private trade in pesticides is not encouraged. The greater portion of consumption is for agricultural purposes, with little household use, but in recent years considerable amounts have been used for public health purposes. Agricultural use is gradually increasing, particularly in the field of organic weedkillers in small grains.

Foreign Trade

Greece does not export pesticides. See table 37 for 1954 imports by principal countries of origin. This table indicates that the United States has considerable competition in the Greek market from the United Kingdom and West Germany.

Equipment

The most commonly used spray equipment is the knapsack type, but since World War II some power-driven sprayers have been imported. Efficient low-cost sprayers and dusters are needed to improve results and reduce cost of pest control in Greece. Recent bids for procurement of power sprayers were awarded to German firms because of low price.

Table 37.—*Greek Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
United Kingdom	3, 488, 910	334, 115
Other countries	3, 319, 210	312, 200
Total	6, 808, 120	646, 315
Insecticides, in general:		
Belgium	15, 712	2, 076
France	308, 675	106, 605
Germany, West	520, 454	138, 981
Netherlands	306, 900	45, 370
United Kingdom	294, 435	83, 506
United States	1, 441, 266	476, 187
Other countries	21, 193	12, 813
Total	2, 908, 635	865, 538

Source: Greek official trade statistics.

Marketing and Distribution

Most pesticides are purchased on a bid basis according to specifications established by the Agricultural Bank. Imported materials are

distributed to branch offices of the Bank which, in cooperation with the unions of the Agricultural Cooperatives, make them available to farmers.

Foreign pesticide producers have agents and distributors in Greece, but business on a private-trade basis is limited because of the large portion of imports brought in by the Agricultural Bank. Bank sales are on short-term or "cultivation" loans, the farmer paying at harvest-time. Other sales are on a 3 to 6 months' credit basis.

Government Decrees and Regulations

Law No. 2147, published in the official gazette on June 5, 1952, provides for the prevention and control of pests and diseases and the organization of the phytopathological service. Particular categories include:

Phytosanitary supervision of agricultural production
Control of pests and diseases by governmental agencies:
  Compulsory control
  Control by the cooperative organizations
Inspection of pesticides
Penal clauses
Organization of the Phytopathological Service and Council.

This law was put into effect immediately with the exception of the section on inspection of pesticides, which will go into force after the Minister of Agriculture proposes a Royal Decree and it is issued.

Prospective Developments and Trends

Greece imports most raw materials required for production of pesticides and it is doubtful that domestic output will rise to any extent. There appears to be little prospect for increased imports by private Greek companies; the principal purchaser of agricultural pesticides probably will continue to be the Agricultural Bank.

ITALY

(Based on report by R. R. Melone, U. S. Embassy, Rome)

Production

Total Italian pesticide production was valued at $44,000,000 in 1953, compared to $48,060,000 in 1952, and $39,550,000 in 1951. About 60 firms produce several types of pesticides; additional firms engage exclusively in compounding and packaging operations. There are relatively few firms in the latter category because the majority of Italian pesticide manufacturers also formulate finished products.

Below is an estimate of annual output of principal pesticides (probably includes formulations) produced in Italy and the number of manufacturers of each.

Commodity:	*Metric tons*	*Number of manufacturers*
Copper sulfate	75, 000	13
Copper oxychloride	4, 000	7
Sulfur and its derivatives (pesticides)	50, 000	25
Iron sulfate	3, 000	7
Calcium and barium sulfides and polysulfides	7, 100	16
Carbon bisulfide	1, 100	11
Arsenates	1, 850	10
Nicotine compounds	250	8
DDT	1, 650	9
BHC	1, 600	2

The Italian chemical industry is well developed and most basic chemicals required for manufacture of pest-control products can be obtained locally. However, Italy must import all copper needed for making copper compounds, as well as certain raw materials required in the production of many basic chemicals.

No direct or indirect subsidy is given domestic pesticide manufacturers. The only benefit is refund of a portion of the transaction tax (in effect since August 1954) paid on all pesticides exported from Italy. The refund is on percent of the value of the exported product.

Consumption

Total value of pesticides used by Italian farmers in 1951 was estimated at $36.8 million, and in 1952 rose to $44.8 million. Consumption in 1953 amounted to 149,010 metric tons with an estimated value of $44.5 million.

Tables 38 and 39 show volume of important pesticides consumed in agriculture and used by Italian public health authorities in antimalarial campaigns. Statistics on consumption of household insecticides are not available.

Foreign Trade

The quantity of pesticides imported in 1953 was exceptionally large compared with that of 1952 and 1951, but represented only about 4 percent of the value of pesticides consumed by Italian farmers in that year. The substantial increase in 1953 imports was largely due to the fact that during that year (as well as in the early part of 1954) the United Kingdom and Belgium-Luxembourg were able to supply large quantities of copper sulfate at prices lower than those quoted by domestic manufacturers. In fact, copper sulfate accounted for 82.8 percent of the quantity and 66.7 percent of the value of all pesticides imported into Italy in 1953. Less important pest-control

Table 38.—*Italian Consumption of Agricultural Pesticides, 1949–50 to 1952–53*

Commodity	Consumption (metric tons)			
	1949–50 [1]	1950–51 [1]	1951–52 [1]	1952–53 [1]
Copper sulfate	70, 436	78, 136	85, 415	55, 912
Copper oxychloride	3, 575	6, 045	6, 269	3, 522
Other copper compounds [2]	56	109	131	116
Sulfur (refined, sublimed and wettable)	37, 324	45, 059	41, 918	36. 827
Sulfur, cupric	4, 462	5, 137	5, 429	5, 942
Iron sulfate	3, 030	2, 540	2, 469	2, 925
Sulfides and polysulfides	6, 069	6, 101	7, 863	6, 960
Carbon bisulfide	1, 194	1, 101	939	953
Arsenates	2, 046	2, 755	1, 731	1, 235
Barium fluosilicates	54	63	44	12
Zinc phosphide	39	54	63	72
Petroleum oil derivatives	3, 802	3, 308	3, 191	2, 225
Quassia wood and extract	175	256	240	160
Nicotine compounds	477	310	246	215
DDT [3]	1, 524	1, 386	860	853
BHC [4]	813	1, 253	1, 387	1, 929
Chlordane	133	107	51	65
Phosphatic insecticides	34	79	194	245
Sodium cyanide	--------	--------	339	307
DD [5]	--------	--------	206	385
2,4–D and derivatives	--------	--------	221	129
MCPA and derivatives [6]	--------	--------	30	17
Other pesticides	12	2	19	61

[1] August 1–July 31.
[2] Copper oxide and copper carbonate.
[3] Wettable and nonwettable powders, emulsions, and solutions.
[4] Technical basis and gamma isomer in wettable and nonwettable powders, emulsions, and solutions.
[5] Dichloropropane and dichloropropene (a soil fumigant).
[6] Methyl chlorophenoxyacetic acid (a weed killer).

Source: Italian Central Institute of Statistics.

Table 39.—*Pesticides Used in Italian Antimalarial Campaigns, 1950–53*

Product (toxic ingredient only)	Consumption (metric tons)			
	1950	1951	1952	1953
DDT (solutions of various percentages)	229	370	193	255
Chlordane (74 percent emulsionable solution)	18	150	21	1
Methoxychlor (40 percent solution)	--------	14	2	1
Dieldrin (40 percent solution)	--------	--------	10	1
Other products	3	4	--------	--------

Source: Office of High Commission of Public Health, Rome.

products imported are: Other copper compounds, sodium cyanide, botanical insecticides (rotenone, pyrethrum, etc.), and all domestic requirements of aldrin, allethrin, chlordane, dieldrin, dinitro-ortho-cresol compounds, dithane, warfarin, and petroleum oils.

Italian exports of pesticides consist chiefly of refined and sublimed sulfur and DDT. The exportation in 1954 of a large quantity of

copper sulfate (to Greece and Turkey) is an exception to the usual pattern. Because Italy was unable to maintain its exports of refined and sublimed sulfur at the 1952 level, overall pesticide exports dropped considerably in 1953 and remained low in 1954. Exports of domestically produced DDT to a large number of countries are continuing at about the same pace as in 1951 and 1952. A significant change in the pattern of Italian exports of pest-control products probably will not occur in the near future.

Table 40.—*Italian Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Pyrethrum	25, 794	191, 802
Copper sulfate:		
Austria	796, 178	69, 742
United Kingdom	12, 097, 743	1, 113, 435
Other countries	1, 102	393
Total	12, 855, 023	1, 183, 570
Disinfectants, insecticides, fungicides, weedkillers, etc.:		
France	174, 604	41, 232
Germany, West	1, 531, 315	369, 864
Switzerland	1, 414, 692	187, 546
United Kingdom	607, 808	120, 338
United States	433, 645	72, 634
Other countries	250, 663	50, 791
Total	4, 412, 727	842, 405

Source: Italian official statistics.

Table 41.—*Italian Exports of Pesticides, 1954*

Commodity classification and principal countries of destination	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
Greece	3, 279, 783	299, 342
Turkey	1, 054, 240	122, 920
Other countries	146, 826	16, 912
Total	4, 080, 849	439, 174
Insecticides, fungicides, weedkillers, disinfectants, etc.:		
Czechoslovakia	336, 201	17, 587
Italian Somaliland	99, 648	36, 227
Liberia	37, 699	17, 498
Other countries	266, 536	76, 608
Total	740, 084	150, 920

Source: Italian official statistics.

Equipment

The supply of equipment needed for spraying and dusting is adequate. (It is not reported whether domestic or imported equipment is used.)

Marketing and Distribution

Most imported pesticides arrive from the United States, Germany, United Kingdom, and Switzerland. Other countries, particularly Germany, offer lower prices for many products than does the United States; for instance, BHC, grain fumigants, lindane, paradichlorobenzene, parathion, sodium chlorate, warfarin, 2,4–D, and 2,4,5–T.

Imports are acquired through direct purchase. European suppliers usually request payment by irrevocable letters of credit but when dealing with reputable and well-known importers, terms of from 30 to 90 days are often granted. Pesticides are marketed by importers acting as exclusive distributors for foreign manufacturers.

The greatest portion of pesticides used in Italy is purchased and distributed by the Federazione Italiano dei Consorzi Agrari, Rome, a very large farmer cooperative having branches throughout the country. This organization, as well as the Alto Commissariato per L'Igiene e la Sanita' Publica, Rome (the public health authorities conducting the antimalarial campaign), sometimes purchases directly from foreign manufacturers. More often, however, they buy through exclusive distributors after a product has been proved effective. No pesticides are presently being distributed in Italy by the World Health Organization, but negligible quantities are procured under the productivity program sponsored by ICA.

Newspapers and appropriate Italian trade journals are successful advertising media for promoting sales of pesticides, particularly of household insecticides. Posting of billboards and distribution of descriptive literature in agricultural communities, as well as publication of literature suitable for circulation to the Italian equivalent of United States county agents, are also helpful.

Government Decrees and Regulations

In accordance with a decree of September 21, 1954, pesticides are subject to registration with the Office of the High Commissioner of Public Health in Rome. Procedures are similar to those applying to medicinals. Hence, pesticides can be imported into Italy subsequent to registration only by a local firm acting as exclusive representative-distributor for the actual foreign manufacturer. The appointment of such a representative must be made by power of attorney duly legalized by the Italian diplomatic or consular mission in the country of the foreign principal. The above requirements apply only to

packaged pesticides ready for sale to the consumer, not to products imported in bulk.

Under existing laws, the Interministerial Price Committee fixes wholesale and retail prices for copper sulfate and copper oxychloride. November 1954 prices (per pound) were as follows:

	Wholesale	*Retail*
Copper sulfate (98–99 percent)	$0. 10	$0. 104
Copper oxychloride (16 percent copper)	. 09	. 0927

Prospective Developments and Trends

The domestic industry can supply at least 95 percent of Italy's pesticide requirements. Since there is no indication of an extensive increase in consumption in the foreseeable future, the Embassy does not envisage any opportunity for investment of United States capital or technical knowledge in the Italian pesticide industry. Nevertheless, because of cheap labor, geographic location, and the liberal policy governing trade with countries in the European Payments Union, Italy should be considered by United States companies planning to manufacture pesticides in Europe for sale in Europe and the African and Asiatic countries in the Mediterranean area.

The Italian Government limits dollar imports to essential items not produced domestically or obtainable from countries in the European Payments Union. Thus, any improvement in the competitive position of United States pesticides is predicated on Italy's ability to liberalize trade with the dollar area.

NETHERLANDS

(Based on report by G. J. Deitz, U. S. Embassy, The Hague)

Production

There are eight pesticide manufacturers in the Netherlands, most of whom also produce industrial chemicals. Over 90 percent of DDT output is by N. V. Insecto, Oss. Raw materials for the manufacture of pesticides are largely imported, although chemicals required for production of DDT are provided by the Royal Netherlands Salt Company. (See table 42 for estimated production of pesticides in 1953.)

Consumption

Present consumption of pesticides in the Netherlands is small compared to potential use. Because of the rapid development of new products, an estimate of future consumption is not possible. There is

a trend toward pesticides of less toxicity to man and animals, and important discoveries in that field would change the present pattern of consumption. (See table 43 for estimated consumption of pesticides in 1952.)

Foreign Trade

Leading foreign suppliers of pest-control products are West Germany, the United Kingdom, and the United States. In 1954, West Germany furnished an increased portion of supplies.

Equipment

There is an ample supply of modern spraying and dusting machinery in the Netherlands. Exports of such equipment are substantial.

Table 42.—*Estimated Production of Pesticides in the Netherlands, 1952*

[Toxic ingredient]

Commodity	Production (metric tons)	Commodity	Production (metric tons)
DDT	300	Tetramethyl thiuram disulfide	30
BHC	600	Methyl chlorophenoxyacetic acid (MCPA)	400
Parathion	40	Thallium compounds, strychnine compounds, and methyl bromide	100
Dinitrocresol	500	Tar-oil washes	2, 000
Copper oxychloride	1, 000		
Lime-sulfur	3, 500		
Sulfur (agricultural)	900		
Organic mercury compounds	100		

Source: Netherlands Ministry of Agriculture.

Table 43.—*Estimated Consumption of Pesticides in the Netherlands, 1952*

[Toxic ingredient]

Commodity	Consumption (metric tons)	Commodity	Consumption (metric tons)
DDT	200	Tetramethyl thiuram disulfide	30
BHC	200	Arsenic trioxide	120
Parathion	150	Thallium compounds, strychnine compounds, and methyl bromide	50
Dinitrocresol	300	Tar oils	1, 800
Copper oxychloride	1, 500		
Lime-sulfur	1, 800		
Sulfur	800		
Organic mercury compounds	60		

Source: Netherlands Ministry of Agriculture.

Table 44.—*Netherlands Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Paradichlorobenzene:		
United States	110, 230	17, 424
Other countries	2, 205	264
Total	112, 435	17, 688
Copper sulfate:		
Belgium	2, 213, 418	205, 656
Other countries	187, 391	16, 896
Total	2, 400, 809	222, 552
Insecticides, fungicides, etc.:		
Packaged in tablet form, total	101, 412	89, 232
Other than packaged in tablet form:		
Belgium	1, 067, 026	224, 400
Germany, West	3, 829, 390	805, 200
Switzerland	1, 507, 946	240, 768
United Kingdom	1, 194, 893	304, 128
United States	376, 987	100, 848
Other countries	108, 025	39, 600
Total	8, 084, 267	1, 714, 944

Source: Netherlands official statistics.

Table 45.—*Netherlands Exports of Pesticides, 1954*

Commodity classification and principal countries of destination	Quantity (Pounds)	Value (U. S. dollars)
Paradichlorobenzene, total	875, 226	97, 944
Copper sulfate, total	34, 478	4, 224
Insecticides, fungicides, etc.:		
Packaged in tablet form, total	220, 460	157, 344
Other than packaged in tablet form:		
Belgium	1, 108, 914	181, 896
Brazil	1, 031, 753	109, 032
Colombia	202, 823	26, 664
Cyprus	178, 573	23, 760
Ecuador	59, 524	24, 816
Finland	216, 051	21, 120
French Morocco	1, 243, 394	75, 768
India	1, 331, 578	106, 656
Indonesia	2, 431, 674	345, 840
Nicaragua	723, 109	64, 416
Surinam	266, 757	17, 952
Sweden	227, 074	52, 536
Turkey	275, 575	7, 920
Yugoslavia	189, 596	68, 640
Other countries	2, 032, 641	460, 947
Total	11, 519, 036	1, 587, 963

Source: Netherlands official statistics.

Marketing and Distribution

With regard to quality and packaging, United States pesticides compare favorably with domestic or other foreign brands. However, prices for United States products average about 5 percent more than for pesticides from European countries. It is reported that sales under irrevocable letters of credit and slow deliveries by United States firms are deterrents to greater participation in the Dutch market. German and British exporters generally sell under payment against documents, and at times German exporters extend 30 days' credit.

Government Decrees and Regulations

All pesticides sold in the Netherlands must have the approval of the Plant Inspection Service, which carries out extensive tests before granting licenses. Regulations establish an interim prior to harvest when certain highly toxic pesticides can not be used on food crops.

Prospective Developments and Trends

Consumption of pesticides in the Netherlands is expected to increase. Dutch manufacturers use modern techniques and equipment is generally good. Increased sales of United States products in the Netherlands are dependent on appointment of local representatives who will actively promote such sales, broadening of credit terms, and speedier deliveries.

NORWAY

(Based on report by B. Leborg and W. F. Spengler, U. S. Embassy, Oslo)

Production

The only pest-control products manufactured in Norway are sodium chlorate, micronized sulfur, and lime sulfur, all of which are produced from domestic raw materials. The domestic supply of elemental sulfur is particularly plentiful. Other pesticides consumed in Norway are imported, almost entirely in finished form. Some packaging is done locally, particularly of DDT products.

According to the Ministry of Commerce, there are four producers of pesticides. One company produces 500–600 metric tons of micronized sulfur annually, most of which is exported; another manufactures 1200–1300 tons of sodium chlorate, most of which also is exported; two companies produce small quantities of lime sulfur, output of which totaled 125 tons in 1952, but has since declined.

The hormone type of pest-control products—weedkillers and growth stimulants—were formerly purchased from the United States but now are obtained from a manufacturer in Denmark operating on a license from a United States firm.

No subsidies are granted Norwegian producers of pesticides. Instead, the producer of sodium chlorate is required by government regulation to market part of his production domestically at prices below the world market.

Consumption

Official statistics on consumption are not available. As Norway is almost entirely dependent on imports for most pest-control products, import statistics would indicate consumption with the exception of sodium chlorate and sulfur.

In 1953, 1,104,705 pounds of insecticides and related materials, with a value of $308,000, and 46,300 pounds of rodenticides, valued at $25,000, were imported. The 1954 statistics show little change—1,187,270 pounds of agricultural pesticides, valued at $365,120.

In general, demand for pesticides is comparatively small, largely because of climatic conditions (long winter and short, comparatively cool summer). So far herbicides have been used mainly in horticulture and only recently have been applied on agricultural crops. Consumption is expected to increase substantially in coming years, particularly in grain fields. According to an agricultural census, on June 30, 1954, Norwegian grain acreage totaled 464,500 acres. Hence, the potential market for organic weedkillers is sizable.

Both the Ministry of Agriculture and a representative of the trade are of the opinion that consumption of pesticides will double by 1960.

Foreign Trade

See import statistics under "Consumption" above. The leading supplier of pesticides to Norway is the United Kingdom, which furnishes between one-fourth and one-third of annual requirements. Other leading suppliers are Denmark, the United States, Sweden, West Germany, and the Netherlands, in approximately that order.

Except for relatively large exports of sodium chlorate and some mirconized sulfur, Norway seldom exports pesticide chemicals.

Equipment

The shortage of spraying and dusting equipment which prevailed during the early postwar years has been overcome and there is now an ample supply in Norway.

Marketing and Distribution

Because of the limited Norwegian market, most importers find it cheaper to obtain pesticides in finished form, but some large distributors prefer to package products and sell under their own trade names.

Pesticides are imported and distributed by wholesalers who prefer to deal directly with foreign exporters or manufacturers rather than through local import commission agents.

It is the general opinion of the trade that United States pesticides compare very favorably with those of other supplying countries, particularly with regard to quality. However, European products are lower priced, and payments for imports from the United States are usually on a basis of cash against documents while European exporters frequently grant from 3 to 9 months' credit.

The preferred advertising medium for pesticides appears to be Norwegian trade journals. Advertisements may be under the name of either the manufacturer or the manufacturer's Norwegian distributor.

Government Decrees and Regulations

All pest-control products for use in agriculture must be approved by the Norwegian Plant Protection Institute under the Ministry of Agriculture. Biological tests on new products require from 1 to 2 years. Rodenticides must be tested and approved by the Health Directorate, which may require that tests be repeated every 6 months.

All imports into Norway must be licensed by the Export-Import Directorate of the Ministry of Commerce. Imports from the United States are restricted by lack of dollar exchange. As a rule, no product obtainable from countries in the Organization for European Economic Cooperation (OEEC) can be imported from the United States unless the United States price is at least 15 percent lower.

Prospective Developments and Trends

The Norwegian market for pesticides is too small to support profitable production aside from those already being manufactured, and there would seem to be little opportuntiy for introduction of United States capital or technical knowledge in the domestic industry.

OEEC countries have a distinct advantage in the Norwegian market for pesticides, since most of their pesticides are "free listed" and licensed automatically for import. Licenses for imports from the United States are granted only for those products which cannot be obtained from an OEEC country, or where a considerable price advantage exists. Many products formerly purchased from the United States are now manufactured in Europe. One example is

warfarin, which was introduced into Norway under its United States trade name some years ago but now is imported from West Germany.

Other factors affecting the competitive position of United States pest-control products are price, terms of payment, and delivery time. Importers state that payment by cash against documents hinders imports of United States pesticides since European suppliers give relatively long credit terms. Most pesticides are imported early in the year, distributed during the spring and summer, and paid for in the fall when crops are harvested. With respect to delivery time, importers suggest that United States pesticide manufacturers should assemble stocks in European free ports from which deliveries could be made as quickly as European suppliers could ship from their factories.

PORTUGAL

(Based on report by J. J. Jova and D. F. Barboasa, U. S. Consulate, Oporto)

Production

The Compahnia Uniao Fabril is the only manufacturer of copper sulfate, insecticidal sulfur, calcium arsenate, and sodium fluoroacetate. Copper sulfate production in 1953 was 13,662 metric tons, and in 1954, 10,823 tons. Statistics on the company's output of insecticidal sulfur, calcium arsenate, and sodium fluoroacetate are not available.

Under licensing arrangements with the Geigy Company of Switzerland, the Industria Nacional de Productos Quimicos began manufacture of DDT (100 percent) in 1949 and in the next 3 years produced 70 to 80 metric tons annually. However, in 1953 only about 31 tons were manufactured. In the same year the company produced about 1,200 pounds of coumarin-base rodenticides. Raw materials for production of DDT are available domestically with the exception of monochlorobenzene, which is imported. High prices for domestic raw materials raise production costs to such an extent that only tariff protection enables the one manufacturer to compete with imported DDT.

Consumption

Data on consumption of pesticides in Portugal are not available. Production plus imports (see "Foreign Trade") probably closely approximates consumption.

Foreign Trade

Import statistics do not give a breakdown on commodities. Table 46 gives over-all figures and countries of origin. Portugal does not export pesticides.

Table 46.—*Portuguese Imports of Insecticides and Similar Preparations, 1952–53*

[Quantity in pounds; value in U. S. dollars]

Country of origin	1952		1953	
	Quantity	Value	Quantity	Value
Belgium-Luxembourg	390	840	94, 815	29, 750
Germany, West	50, 715	72, 275	145, 530	109, 830
Netherlands	22, 050	8, 680	83, 790	32, 095
Switzerland	1, 600	3, 255	123, 480	56, 630
United Kingdom	639, 450	182, 245	235, 935	54, 880
United States	141, 120	78, 400	134, 505	59, 850
Other countries	2, 053	525	15, 618	10, 955
Total	857, 378	346, 220	833, 673	353, 990

Source: "Commercio Externo," National Institute of Statistics.

Equipment

With the aid of U. S. Government agencies, the Portuguese Agricultural Department was supplied with spraying equipment, which is being used extensively in a program of teaching farmers how to obtain larger crops and to improve the quality of agricultural products. Some individual farmers have acquired their own equipment, but most rent machinery at low rates from the farmers guilds of which they are members.

Marketing and Distribution

Pesticides are sold through distributors located in all agricultural centers or directly to the farmers guilds.

Prospective Developments and Trends

The consensus seems to point to little increase in the use of pesticides in Portugal. Most farmers have very low incomes, use antiquated farming methods and spend little on pest-control products except for protection of vineyards. Domestic production of pesticides was down in 1953, and imports were below those in 1952 (poundwise).

RUMANIA

(Excerpts from an article in Rumanian *Foreign Trade*, August 1954, edited by the Chamber of Commerce of the Rumanian People's Republic, Bucharest)

In recent years the Rumanian chemical industry has developed greatly. Based on large resources of raw materials—coal, oil, salt,

and natural gas—and using the most modern equipment, this industry is now composed of numerous big units such as "Carbochim," "Argesul," and the B. H. Brea works.

The Rumanian chemical industry is concerned with manufacturing various products used in agriculture which will increase the yield of grain, fruit trees, and vineyards, and the growth of flowers and vegetables. Many pesticides are now made in such quantities as not only to meet domestic requirements but also to allow a margin for export.

In the course of research work undertaken to displace copper compounds in the treatment of honeydew melons, a number of products have been tested, such as "Henda" (hexanitrodiphenilamin), and "Tiodin" (thyocanodinitrobenzene), which have given promising results.

DDT and BHC are manufactured and used in sizable quantities. DDT is applied against insects on plants and for protection of stored grain. BHC is used in combating weevils, locusts, and insects which damage the cotton crop and fruit trees. By making use of the inactive isomers of BHC, two additional important products have been obtained, namely "Hexa" (hexachlorobenzene) with fungicidal properties (used as a seed protectant), and "Penta" (pentachlorophenol), used for wood preservation. The Rumanian chemical industry also produces ANTU (alphanaphthyl thiourea), widely used for control of rats. Production of 2,4–D is being considered.

Research work is constantly carried on in the field of pesticides and the range of products is being widened. It is anticipated that, in addition to providing materials for protection of Rumanian agriculture, the industry will also export considerable quantities of pest-control products.

SPAIN

(Based on report by M. Dela Sierra, U. S. Embassy, Madrid)

Production

Domestic production of pesticides has reached such proportions that very few import licenses for these compounds are granted. There are 155 Spanish manufacturers of pesticides, of which the following number manufacture the products indicated:

Insecticides:	
Arsenicals	25
Organic synthetic compounds	75
Oil emulsions	66
Other	60

Fungicides:	
Copper compounds	34
Sulfur and derivatives	21
Compounds of sulfur and copper	15
Other	1
Mixtures of insecticides and fungicides	10
Disinfectants	29
Other pesticides	52

As evidenced by the above figures, many firms manufacture several types of pesticides; only three firms are known to produce virtually all types. Approximately 600 pesticide products of domestic manufacture and 60 foreign pest-control products are registered for distribution in Spain.

In 1953 Spain produced the following major pesticide materials (output in 1954 is estimated to be approximately the same):

	Metric tons
DDT	500
BHC	600
Lindane	120
Oil emulsions	4, 823
Arsenicals	1, 500
Copper sulfate	16, 807
Sulfur (for pesticides)	17, 000
Hydrocyanic acid	154

Compound H–24, a terpene derivative based on turpentine, also is manufactured and used against plant lice and other harmful insects, as well as for control of ants.

Spanish production of DDT, BHC, lindane, nicotine, and arsenicals is reported sufficient to supply domestic requirements, as well as is sulfur used for pesticides. Chlordane, pyrethrum products, synthetic hormone compounds, and synthetic cryolite are manufactured (probably formulated) in small quantities.

Consumption

Data on annual consumption of pesticides are not available, although apparent consumption may be computed by adding imports to domestic production. About 80 percent of production is used for agricultural purposes, 13 percent for household uses, and 7 percent for public health.

There is need for additional education of the farmer before use of pest-control products will measurably increase. When benefits to be derived from application of pesticides in agriculture are more fully known, undoubtedly consumption will rise..

Foreign Trade

At present, import licenses for pesticides are granted only for essential commodities not produced in Spain.

Spain imports copper sulfate as well as copper for its domestic production. Sodium cyanide and calcium cyanide also are imported. Rotenone is imported in small quantities. Aldrin and dieldrin insecticides have been imported and tested, but have not yet (1954) been authorized for sale. Seed disinfectants, such as copper salts and organic mercury compounds, are imported, as are some rodenticides.

All imports into Spain are subject to license, which must be obtained by the importer before any shipment will be cleared by the customs. Permit for importation of goods in general may be granted for transactions of the following types:

(1) "Sin divisas ni compensacion," or without foreign exchange when the importer has officially declared that he holds funds abroad and wishes to import products not normally produced in Spain;

(2) "Cuenta combinada," or combined account, when a firm which must import certain foreign products for its normal activities obtains permission to establish a special import-export account;

(3) "Cuenta de compensacion," or individual barter transaction accounts; and

(4) Regular imports for which exchange is granted.

Validity of import licenses is generally 3 months, and expired licenses are seldom renewed. The exporter must furnish to the Spanish importer a pro forma invoice, in sextuplicate, to be attached to the import license application, showing the f. o. b. foreign port price of the goods to be imported. Freight and insurance charges for calculating the c. i. f. Spanish port price should also be included.

Since production capacity for some pesticide materials is twice as much as actual output, it would appear that Spain could produce these commodities for export. However, cost of manufacture is high and Spain's potential foreign markets are considered unimportant. Nevertheless, the Government includes pesticides in the most favorable exchange rate group for exports (37.245 pesetas=U. S. $1).

Table 47.—*Spanish Imports of Pesticides, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Copper sulfate:		
Chile	117, 260	$17, 598
Germany	4, 342, 580	495, 419
Total	4, 459, 840	513, 017
Compounds used in combating plant and animal diseases:		
France	80, 080	38, 208
Germany	333, 740	105, 196
Netherlands	459, 360	127, 736
Other countries	14, 520	5, 264
Total	887, 700	$276, 304

Source: Spanish official trade statistics.

Equipment

Machinery for spraying and dusting is domestically produced but as a rule is not of the quality needed for up-to-date farming practices. Approximately 31 manufacturers and 7 importers of spraying and dusting equipment are registered in Spain.

Two Spanish firms are engaged in aerial crop dusting and spraying under concession granted by the Ministry of Agriculture:

Servicios Agricolas Aereos, S. A., which holds 80 percent of the concession (this firm is associated with a United States firm engaged in aerial agricultural work).

Aeroteonica, S. A., which holds the remaining 20 percent of the concession.

Marketing and Distribution

Manufacturers' local representatives who have their own sales agents are the preferred media for distribution of pesticides. Protection against plagues is dependent on the "Seccion de Fitopatologia y Plagas del Compo" (Service of Phytopatology and Plagues) of the Directorate General of Agriculture, which buys and distributes insecticides whenever a plague threatens the national interest.

Advertising is usually arranged for by the importer or sales representative with support from the foreign manufacturer. Prior to distribution, all advertising material and publicity on pesticides must be censored and approved by the Directorate General of Agriculture. There is keen competition in pesticides, which are among the most highly advertised commodities in Spain.

Government Decrees and Regulations

All pesticide materials and equipment for agricultural use must be approved by and registered with the Ministry of Agriculture Registrar's Office of Phytosanitary Products and Equipment. All products sold must bear a label showing the registry number, name of the producer, and the chemical formula.

No imported pesticide will be released by the customs if not previously registered with the Registrar's Office. (Decree, September 10, 1942; Order, December 16, 1942.)

Products for household and public health use must be approved by the Ministry of Interior and registered at the Office of the Inspector General of Pharmacy before they may be sold. Such products also must bear a label giving registration number and the chemical formula. (Order, May 8, 1947.)

Prospective Developments and Trends

Trade sources indicate that further investment in the pesticide business is not advisable, as national production already practically covers domestic requirements and capacity is greater than present output. However, the industry feels that there are opportunities for participation of United States technique in the pesticide industry in collaboration with Spanish firms.

The chronic shortage of dollar exchange necessitates limiting of imports from the United States to essential items not produced in Spain and not available from soft-currency sources. Therefore, any increase in United States exports of pesticides to Spain probably will consist of products manufactured only in the United States.

SWEDEN

(Based on report by Georg Frostenson, U. S. Embassy, Stockholm)

Production

About 70 Swedish firms, 20 of importance, compound and pack pest-control products. All the firms are principally blenders and packers. Use of toxic ingredients of domestic origin is small.

Production (probably formulation in some cases) of pesticides in 1951 (latest year available) was as follows (in million tons):

Arsenic products	18, 531
Copper sulfate	1, 078
Sodium chlorate	3, 489
Sulfur, agricultural	15, 033
Seed treatment materials	451
Herbicides, etc	4, 760
Insecticides (probably formulations)	1, 015

Chemicals for production of pesticides, such as ethyl alcohol, phosphoric acid, sulfuric acid, and chlorine, are manufactured in Sweden.

Consumption

Use of pesticides has increased at a rapid rate and has more than doubled since 1948, as indicated by tables 48 and 49.

It is estimated that distribution of pesticides as to application in 1953 was in the following percentages: Agriculture, 74; horticulture, 18; forestry, 3; public health, 2; household, 3.

Table 48.—*Approximate Consumption of Pesticides in Swedish Agriculture and Horticulture for 1948, 1952, and 1953, with Projected Use in 1960*

[Metric tons]

Commodity	Consumption			Estimated use in 1960
	1948	1952	1953	
Insecticides	1, 570	2, 683	2, 369	3, 200
Fungicides	1, 110	2, 396	2, 869	4, 000
Weedkillers	1, 058	2, 593	3, 249	6, 000
Rodenticides	62	159	307	500
Miscellaneous [1]	46	470	293	[2]
Total	3, 846	8, 291	9, 087	13, 700

[1] Compounds for control of storage insects, etc.
[2] No basis for estimate.
Source: The Agricultural Economics Institute.

Table 49.—*Sweden: Approximate Consumption of Principal Pesticide Materials, 1953*

[Metric tons]

Commodity classification	Total consumed	Toxic ingredient
Insecticides containing principally:		
DDT	840	101
BHC	990	148
Chlordane and lindane	85	17
Thiophosphates	380	27
Arsenic	95	80
Nicotine	17	5
Winter sprays	95	10
Other	148	7
Fungicides:		
Seed-treatment compounds (principally mercury)	500	4
Other (copper, sulfur, etc.)	2, 369	24
Weedkillers (largely sodium chlorate)	3, 449	1, 213
Rodenticides (principally coumarin compounds)	582	[1]
Total	9, 550	1, 636

[1] Less than one metric ton.
Source: The Agricultural Economics Institute and trade estimates.

Consumption of pesticides imported in minor quantities was as follows:

	(Metric tons)
Dieldrin	1–2
Lindane	25
Parathion	25
Pyrethrum	3
2,4–D	50
2,4,5–T	50
Aramite	5
Piperonyl butoxide	12
Malathion	3
Heptachlor	1

The factors which indicate a continued and relatively rapid increase in the long-trend use of pest-control products are: The Swedish farmer enjoys government income guaranties at a relatively higher level; high farm wages increase profitability of chemical weed control; use of brush-killing materials in forestry is expected to increase; Swedish farms are relatively well mechanized and collective use of spraying and dusting equipment is common; dusting from airplanes is well established; adequate information services on types of pesticides and application methods are available; the importance of rat and fly control is more fully recognized since the typhus cases in 1953 and 1954.

On the other hand, reduction in oil-crop cultivation has caused a temporary decrease in the use of insecticides.

Foreign Trade

Volume of imports of pesticides has increased considerably in proportion to rising use. Imports of ready-made compounds have decreased in favor of toxic ingredients and now amount to less than 15 percent of pesticide imports. Availability of superior products will continue to be the most inportant factor in determining the source of supply. In that regard the United States is outstanding, but increased competition may be expected from West Germany. The small domestic market and increased competition limits Sweden's possibilities of synthesizing pest-control products or building up an export market. Production of DDT in Sweden has been discontinued for competitive reasons. See table 50 for statistics on Swedish exports and imports of pesticides in 1953.

Equipment

Spraying and dusting equipment is in adequate supply. The owners of large farms have their own equipment and most small farmers can avail themselves of custom spraying and dusting services.

Marketing and Distribution

Pesticides are generally imported through local agents, with one firm handling about three-fourths of the total. These products are subject to an import duty of 15 percent ad valorem except for pesticides from the United States which were "free listed" on October 1, 1954.

Foreign manufacturers advertise in newspapers and periodicals. Some Swedish manufacturers (probably formulators) also have a broad educational program which includes issuance of pamphlets and dissemination of information to farm schools, agricultural advisors, and farm organizations.

Table 50.—*Swedish Foreign Trade in Pesticides, 1953*

Commodity classification and principal countries of origin or destination	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Copper sulfate:		
Belgium and Luxembourg	522, 490	50, 232
Denmark	24, 251	2, 705
Germany, West	108, 025	10, 819
United Kingdom	533, 513	53, 323
Total	1, 188, 279	117, 079
Insecticides, fungicides, etc.:		
Denmark	17, 637	22, 604
Germany, West	156, 527	54, 096
Netherlands	52, 910	26, 662
Switzerland	22, 046	54, 869
United Kingdom	130, 071	37, 094
United States	13, 228	15, 456
Other countries	2, 205	6, 569
Total	394, 624	217, 350
EXPORTS		
Insecticides, fungicides, disinfectants (including sheep and cattle dressings), and similar preparations:		
Australia	11, 023	9, 853
Belgium-Luxembourg	88, 184	4, 637
Bulgaria	26, 455	19, 900
Other countries	6, 614	4, 443
Total	132, 276	38, 833

Source: Swedish official trade statistics.

Government Decrees and Regulations

Control and inspection of domestic and imported pesticides are conducted by the State Plant Protection Institute in accordance with its original instruction (SFS No. 579, December 16, 1932) and Public Law No. 589, September 22, 1953, concerning registration of pest-control products.

A pesticide may not be sold unless it is registered. The registering firm is required to declare the contents of the product, submit a sample, and give information concerning toxicity to humans. The Institute makes no biological tests prior to registration but may make a chemical analysis of the sample, in which case a certain fee is charged in accordance with the law.

A pesticide toxic to humans is also subject to the Poisons Act of 1943 (SFS No. 877, November 26, 1943) or to special instructions given in each individual case by the State Institute for Public Health. The Board of Health may prohibit the sale of dangerously toxic pesticides.

Another law (Public Law No. 718, December 11, 1953) prohibits the use of pesticides on blossoming plants visited by bees, but the Board of Agriculture may grant exemptions.

Prospective Developments and Trends

Opportunities for investment of United States capital in the Swedish pest-control industry are believed to be very limited. On the other hand, United States technical knowledge would be welcome because of the limited scope of Swedish research in this field. New United States products are constantly being introduced and tested in Sweden.

With the "free listing" for imports of United States pesticides into Sweden, dollar liberalization, and the popularity of United States products, Swedish imports of pesticides from the United States are expected to increase.

SWITZERLAND

(Based on report by J. A. Lehrs and M. B. Caluori, U. S. Consulate General, Basel)

Production

Swiss requirements of pesticides are largely met by domestic production. Official production statistics are not released, but trade circles estimate that output of pesticides in both 1953 and 1954 was valued at $7,360,000. There are eight major producers of pesticides in Switzerland, listed below with principal products manufactured.

Firm	Pesticides produced	Remarks
J. R. Geigy, A. G., Basel	Insecticides Fumigants Fungicides Weedkillers Rodenticides	Specializes in DDT
Sandoz, Ltd., Basel	Fungicides	Specializes in copper products
Ciba, Ltd., Basel	Fungicides	This large chemical-pharmaceutical firm has recently added the manufacture of pesticides
Dr. R. Maag A. G. Chemische Fabrik Dielsdorf, Zurich.	Insecticides Fumigants Fungicides Weedkillers Rodenticides	Specializes in BHC under license from Imperial Chemical Industries
Cupra S. A., Renens, Vaud	Fungicides	Specializes in copper sulfate
A. G. vorm. B. Siegfried, Sefingen.	Insecticides Fungicides Weedkillers Rodenticides	Manufactures on a small scale
Chemisch-Technische Werke A. G. Muttenz, Baselland.	Insecticides Fungicides Weedkillers	Manufactures on a small scale
Agrochemie A. G., Bern	Insecticides Fungicides	

Switzerland has very few natural resources, hence practically all raw materials for the manufacture of pesticides are imported.

Consumption

Official consumption statistics are not available, but only about half of production is consumed domestically. Probably 80 percent of pesticides consumed is in agriculture, with most of the balance being used for household purposes. There are no endemic diseases in Switzerland, and use of pesticides for public health purposes is believed to be insignificant.

It is not expected that consumption of pesticides will increase to any extent in the near future.

Foreign Trade

In view of the existence of a highly developed pesticide industry in Switzerland, imports of these products are insignificant. A large volume of production is exported, mostly in the form of active ingredients. Available trade statistics cover copper sulfate and fungicides only, as shown in table 51.

United States exports of pesticides to Switzerland dropped from 390,000 pounds ($298,000) in 1954 to 276,000 pounds ($216,000) in 1955. The major portion of exports in each of these years consisted of miscellaneous agricultural insecticides and related materials and household and industrial disinfectants.

Equipment

No shortage of spraying or dusting equipment exists in Switzerland.

Marketing and Distribution

Imported pesticides are usually bought through direct purchase. Principal distributors of pesticides, both those of Swiss origin and imported commodities, are the several agricultural cooperatives. Household insecticides are distributed mainly by wholesalers in the chemical-pharmaceutical field to drug and department stores for retail sale.

Samples of advertising material used by Geigy, Sandoz, and Ciba are on file in the Chemical and Rubber Division.

Government Decrees and Regulations

Sale of both domestic and imported pesticides for agricultural use is permitted only after extensive biological and toxicological tests and

Table 51.—*Swiss Imports and Exports of Copper Sulfate and Fungicides, 1954*

[Quantity in pounds; value in U. S. dollars]

Principal countries of origin or destination	Imports		Exports	
	Quantity	Value	Quantity	Value
Australia			19, 934	21, 730
Austria			13, 073	19, 942
Belgium and Luxembourg	778, 307	88, 504	10, 031	9, 305
Brazil			78, 369	120, 625
Canada			17, 857	14, 271
Colombia			20, 944	21, 227
France	71, 900	9, 627	7, 976	6, 929
Netherlands			21, 605	17, 470
United Kingdom	22, 046	4, 997	25, 787	21, 799
United States	5, 115	2, 789	132, 276	102, 888
Uruguay			30, 542	33, 766
All other countries	9, 404	1, 847	80, 211	96, 657
Total	886, 772	107, 764	458, 605	486, 609

Source: Swiss official trade statistics.

approval by one of the three Federal Testing Stations. Household preparations are tested by the Swiss Toxic Commission of the Federal Health Office.

Containers of all preparations, whether for agricultural, household, public health, or industrial use, must show the amount of toxic ingredients. Pesticides with a toxic content exceeding the allowable percentage must, in addition, be marked by a skull and crossbones.

Prospective Developments and Trends

Switzerland's agricultural production is restricted to its present size, generally speaking, and farmers are well instructed on the use and value of pesticides. The well-developed domestic pesticide industry can largely meet the relatively small Swiss requirements for pesticides. Hence, local trade circles feel that there will be no increase in imports of pest-control products from the United States or elsewhere, except by the introduction of new and specialized commodities.

TURKEY

(Based on report by L. I. Scranton, U. S. Embassy, Ankara)

Production

Turkey has two or three small plants engaged in mixing or formulating pesticides, but none has had outstanding success thus far, due in large measure to lack of foreign exchange for importation of toxic

ingredients and to limited facilities which do not warrant an aggressive marketing program.

One of the largest formulators, with a capacity of approximately 2,500 metric tons, in 1953 produced only about 1,500 tons, consisting of DDT preparations (10 and 50 percent), cereal seed dressing (nonmercurial), locust poison, and a few other items. All toxic ingredients are imported and are reported to include DDT, BHC, metaldehyde, thallium sulfate, methoxychlor, dithiocarbamate fungicides, piperonyl butoxide, and toxaphene. About 80 percent of output is taken by the Ministry of Agriculture and the Turkish Sugar Company for use on state farms or in control campaigns carried on under supervision of these agencies. The remainder is sold on the open market.

A nicotine sulfate factory is under construction with the expectation that nicotine sulfate will be used in domestic agriculture and nicotine extract will be exported. It is being financed by the Industrial Development Bank, with a credit of approximately $64,000 for equipment which has been ordered from Germany.

Domestic raw materials available for production of pest-control products include:

Talc and similar inert materials, said to be in ample supply;

Alcohol, output approximately 8 million liters and could be increased;

Benzol, byproduct of the steel industry (volume unknown);

Sulfuric acid, with principal source as byproduct of Karabuk Iron and Steel Plant (greatly increased supplies are expected from installations to process gases from the Murgul Copper Mine), with domestic requirements on the rise due to completion of the new superphosphate factory at Ishenderun;

Chlorine, produced by Sumer Bank alkali and cellulose factories from hydrolysis of sea salt;

Copper, ample supplies of raw material from Murgul and Ergani Copper Mines, although none processed for pesticides;

Sulfur, from Kecubolu Plant, of high purity suitable for use in dry form (wettable types are imported);

Nicotine, ample supply from tobacco industry.

Consumption

Official data on consumption are not available. According to recent information, the Ministry of Agriculture budget for 1954 included approximately $1,080,000 for purchase of pesticides materials, of which the following were indicated as some of the more important items:

	Pounds
10 percent DDT	537, 900
50 percent DDT	173, 800

	Pounds
BHC	523, 600
Cotton dust	121, 000
White oil	268, 400
Mercuric seed dressing	1, 342, 000
Nonmercuric seed dressing	990, 000
HZ 32 and 132A (toxic ingredient not known in Chemical and Rubber Division)	253, 000
Sulfur	22, 660
Methoxychlor	22, 705
Strychnine sulfate	5, 500
Parathion	5, 500
Thallium sulfate	2, 200
Methyl bromide	19, 800
Other	16, 500

Information from the Ministry of Public Health, responsible for malaria control, indicates that approximately 1,000 metric tons of DDT products were used for that purpose in 1953.

While use of pesticides has increased several fold in the past few years, present consumption is only a small percent of the amount needed or which may be consumed in the future in view of the agricultural and industrial development under way in Turkey.

Virtually all pest-control operations are carried on by, or under supervision of, government agencies, such as public health, sugar companies, and the Ministry of Agriculture (through provincial stations of its Plant Protection Services). A few individual farmers, particularly orchardists and vineyardists, conduct their own control work, but by and large the widespread use of pesticides by farmers for a variety of urgent needs has not yet developed. Greatly expanded use may be anticipated in the future, dependent upon (1) ample supplies readily available at reasonable prices in all rural districts; (2) continued education and demonstration work among farmers, by both governmental and private agencies, on the economic benefits to be derived and approved methods of application; and (3) increased initiative by farmers in taking measures to protect their own crops rather than depending upon the government to do the job for them.

A rough idea of the need and potential demand for pesticides in agriculture is indicated by the list of major crops and controls needed to improve and increase production, given below.

	Quantity	Protection measures needed
Agricultural crops:		
Cereals	27,500,000 acres	Seed dressings, weedkillers, poisons for locusts and other insects
Cotton	15,000,000 acres	Dusts, sprays, and fumigants against green boll worm, pink boll worm, and other cotton insects

	Quantity	Protection measurers needed
Agricultural crops—Continued		
Tobacco	375,000 acres	Control of thrips and diseases
Pulse crops (peas, beans, lentils, etc.)	1,150,000 acres	Control of various insects and diseases
Vineyards	1,625,000 acres	Insect, bacterial and virus control
Citrus	6,000,000 trees	Various insects
Other fruit	59,000,000 trees	Various insects and diseases
Olives	38,000,000 trees	Olive moth, dacus fly, etc.
Filberts	142,000,000 trees	Various insects
Livestock	62,000,000 head	External and internal parasites
Stored products:		
Cereals	2,000,000 metric tons in 1953 stored for redistribution and export by government agency	
Tobacco	100,000 tons a year	
Dried fruits	100,000 tons a year	

An estimated yearly pest damage of $295 million to $320 million, based on statistics originating in the Ministry of Agriculture, included the following pests:

	U. S. dollars
Grasshoppers	35, 700, 000
Grain diseases	71, 000, 000
Fruit web moths	14, 280, 000
Codling moth	5, 355, 000
Cotton insects	7, 150, 000
Citrus insects	8, 925, 000
Olive insects	5, 355, 000
Nut insects	3, 570, 000
Vineyard insects	2, 855, 000
Aphids	2, 140, 000
Wild pigs	250, 000
Rats	180, 000

The above figures are of interest only as they indicate in a general way the scale of the pest-control problems confronting farmers and agencies responsible for agricultural improvement and development in Turkey. They also give some indication of potential marketing possibilities in an expanding and technologically improved economy.

Foreign Trade

Official trade statistics do not provide specific information as to type and quantity of pesticides included. Pesticides are not exported from Turkey. The only available import data are as follows:

	1952		1953	
	Quantity	Value	Quantity	Value
Products for control of rats and mice	362	$298, 450	53	$45, 875
Insecticides, etc	2, 331	1, 305, 405	5, 290	1, 720, 740
Total	2, 693	1, 603, 855	5, 343	1, 766, 515

Equipment

Since most pest-control work is carried on by, or under supervision of, governmental agencies, the bulk of equipment for pesticide application is held by those agencies. An agricultural equipment survey of 1952 shows a total of 20,112 sprayers and 3,746 dusters in the country, types and sizes unspecified. Equipment reported to be in the hands of the Ministry of Agriculture in 1954 for plant protection operations included: 536 motorized sprayers, 201 motorized dusters, 9,320 pressurized knapsack sprayers, 3,317 ordinary knapsack sprayers, 1,100 ordinary knapsack dusters, 2,000 gopher guns, 2,122 mole guns, 825 flame throwers, and 120 trucks and pickups.

The Ministry of Agriculture owns and operates for the benefit of farmers a large number of motorized cereal seed cleaners and treaters which are stationed at various points where farmers can bring seed for treatment. There is need for simple hand-operated equipment to be used by farmers.

The application of weedkillers in grain crops, undertaken on a commercial scale for the first time in 1953, has thus far been done by airplane on the large holdings of the state farms. If chemical weed control becomes more general, animal-drawn and tractor-operated equipment for this purpose will be needed.

Marketing and Distribution

United States pesticides compare favorably with European products as to quality. Since a high proportion of purchases of United States products have been made by governmental agencies, largely through the use of foreign-aid funds, United States trade names may not have become widely known among general users. Owing to shortage of dollar exhange, private importers recently have been unable to bring in significant quantities of pesticides from the United States.

Some European representatives have aggressively advertised and promoted sale of their products. Despite shortage of foreign exchange sufficient to meet demand for pesticides, they have distributed excellent educational and promotional materials, including leaflets, circulars, colored charts and wall posters for agricultural offices and schools, and educational films. (Samples of advertising material used are on file in the Chemical and Rubber Division.)

Government Decrees and Regulations

All pesticides must be tested and approved by agencies of the Ministry of Agriculture before permits for importation and sale are authorized. (A translation of the regulation of February 1, 1954, is on file in the Chemical and Rubber Division.)

Imports of pesticides, except 100 percent DDT, became subject to tariff charges of 25 percent ad valorem on July 1, 1955. Imported chemicals are subject to a general transaction tax of 18 percent of the value. Domestically manufactured products are free of the transaction tax (Law No. 4939). Technical DDT is reported to be exempt from all duties and taxes.

Prospective Developments and Trends

Potential markets for pesticides in Turkey are enormous. Lack of education as to the benefits to be derived from use of these materials, as well as low farm income, are deterrents to a rapid increase in consumption. Lack of dollar exchange also presently handicaps importation of United States pesticides by private Turkish importers.

UNITED KINGDOM

(Based on report by G. A. Ellsworth, U. S. Embassy, London)

Production

Detailed information on output of pesticides in the United Kingdom is not available. The Census of Production for 1948 listed 49 manufacturers of "Disinfectants, antiseptics, insecticides, weedkillers, sheep and cattle dips, and like products," with a total output valued at $24,725,000. The Census for 1950 (latest available) altered the heading to "Fertilizer, disinfectant, insecticide and allied trades," and listed 224 establishments with a gross production amounting to $94,357,800. A reliable source has estimated current production of DDT and BHC at an annual rate of 2,000 long tons each.

Major synthetic pesticides are manufactured in the United Kingdom, with the exception of aldrin, dieldrin, chlordane, and captan. Botanicals—nicotine, pyrethrum, rotenone—are imported, but extraction takes place in the United Kingdom. Such raw materials as lead for lead arsenate are also obtained from abroad.

Consumption

No figures or estimates are available on consumption.

Foreign Trade

Exports of pesticides increased annually from 1949 to 1952, but dropped in 1953. Some recovery took place in 1954. Table 52 gives exports of pesticides for January-November 1954. Table 53 gives available statistics on United Kingdom imports of pesticides in 1954.

Table 52.—*Exports of Pesticides from the United Kingdom, January–November 1954*

Commodity classification and principal countries of destination	Quantity (pounds)	Value (U. S. dollars)
Rodenticides:		
Australia	29, 984	22, 011
Indonesia	11, 536	17, 770
Ireland (Eire)	45, 472	22, 093
New Zealand	12, 656	8, 578
All other countries	66, 640	62, 737
Total	162, 288	133, 189
Weedkillers:		
Argentina	323, 456	187, 541
Belgium	283, 696	39, 829
British Guiana	148, 848	60, 724
Chile	243, 936	91, 015
Denmark	424, 704	48, 718
Finland	159, 600	49, 824
Greece	116, 704	47, 361
Ireland (Eire)	569, 968	201, 746
Kenya	103, 712	48, 544
Mauritius	481, 824	159, 024
Netherlands	280, 000	51, 326
New Zealand	749, 616	224, 201
Southern Rhodesia	151, 648	54, 709
Sweden	1, 290, 800	115, 864
Union of South Africa	288, 064	78, 933
United States	70, 000	39, 344
Uruguay	183, 568	81, 744
All other countries	1, 606, 416	382, 191
Total	7, 476, 560	1, 962, 638
Nicotine, nicotine sulfate, and insecticides containing nicotine:		
Israel	13, 440	12, 685
Japan	40, 884	34, 000
Peru	10, 976	7, 589
United States	51, 184	58, 845
All other countries	52, 860	71, 316
Total	169, 344	184, 435
All other insecticides and fungicides:		
Anglo-Egyptian Sudan	1, 531, 040	301, 621
Australia	1, 545, 600	873, 873
Canada	486, 192	506, 542
Ceylon	6, 297, 312	640, 324
Channel Islands	458, 864	124, 975
Denmark	176, 624	115, 653
Egypt	835, 632	188, 844
Gold Coast	653, 968	173, 793
India	3, 230, 416	372, 355
Ireland (Eire)	837, 088	294, 858
Italy	511, 392	200, 301
Kenya	968, 688	263, 713
Netherlands	653, 968	183, 733
New Zealand	700, 336	341, 746
Pakistan	549, 808	125, 756
Singapore	698, 432	125, 434
Southern Rhodesia	323, 904	126, 751
Sweden	329, 952	142, 993
Trinidad and Tobago	997, 360	163, 718

Table 52.—*Exports of Pesticides from the United Kingdom January–November 1954*—Continued

Commodity classification and principal countries of destination	Quantity (pounds)	Value (U. S. dollars)
All other insecticides and fungicides—Continued		
Turkey	1, 957, 648	238, 679
Union of South Africa	518, 896	189, 422
Uruguay	677, 376	179, 094
Yugoslavia	505, 792	149, 044
All other countries	10, 158, 848	2, 507, 563
Total	35, 605, 136	8, 530, 785
Grand total	43, 413, 328	10, 811, 047

Source: British Board of Trade, Statistics Division.

Table 53.—*Imports of Pesticides into the United Kingdom, January–November 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Disinfectants, insecticides, weedkillers and sheep and cattle dressings, except tobacco offal and nicotine insecticides:		
Denmark	111, 328	37, 657
Germany, West	184, 240	161, 726
Italy	123, 088	30, 925
Netherlands	153, 328	125, 893
Kenya	71, 232	676, 251
Switzerland	156, 128	244, 454
United States	658, 560	387, 560
All other countries	265, 664	96, 421
Total	1, 723, 568	1, 760, 887
Nicotine, nicotine sulfate and nicotine insecticides:		
Netherlands	7, 728	6, 316
Peru	10, 752	4, 329
Union of South Africa	11, 200	3, 215
All other countries	112	182
Total	29, 792	14, 042
Grand total	1, 753, 360	1, 774, 929

Source: British Board of Trade, Statistics Division.

Equipment

Lack of equipment, for some time a limiting factor in the efficient use of pesticides, has been almost completely overcome.

Marketing and Distribution

No information is available on these subjects.

Government Decrees and Regulations

Manufacturers producing pesticides are covered by the Factories Act. All poisonous products, as scheduled in the Poisons Acts, must conform to the conditions of the Pharmacy and Poisons Act, 1933, and the Poisons Rules, 1952, before distribution.

The Agriculture (Poisonous Substances) Act, 1952, gave the Minister of Agriculture power to make regulations to protect workers against risk of poisoning from the use of toxic chemicals in agriculture. The Agriculture Poisonous Substances Regulations, 1954, S. I., 1954, No. 828, states precautions which must be taken by employers and employees when using dinitro weedkillers and organic phosphorus insecticides.

There is a voluntary arrangement for the notification of the Ministry of Agriculture of new toxic chemicals used in agriculture or new uses of known toxic chemicals (Second Zuckerman Working Party Report, *Toxic Chemicals in Agriculture, Residues in Food*).

Also in operation is a voluntary "Approval Scheme for Crop Protection Products." Under this scheme, manufacturers guarantee to conform to specifications prepared jointly by representatives of the Ministry of Agriculture and the trade, or abide by conditions so agreed upon. Labels for the products are approved by an independent committee. Approved products appear in a list issued by the Ministry of Agriculture.

Prospective Trends and Developments

The United Kingdom pesticide industry is well developed and progressive. Backed by well-organized technical, research, and sales staffs, it not only produces needed pesticides, but also in most cases gives technical advice on the efficient use of these materials.

The pesticide industry is extremely competitive, making almost a complete range of products for domestic consumption and for export to a wide area of the world. While there might be a market for specialized pesticides not made in the United Kingdom, probably greater possibilities exist in licensing arrangements with British manufacturers for production in that country.

YUGOSLAVIA

(Based on report by W. N. Turpin, U. S. Embassy, Belgrade)

Production

Yugoslav pesticides produced entirely from domestic raw materials are copper sulfate, copper carbonate, mercury powder, colloidal sulfur, and nicotine. Other pesticides manufactured or formulated,

some raw materials or concentrates of which are imported, include dinitro orthocresol, DDT, BHC, sulfur, and lead arsenate. Production for calendar year 1953 is given below.

Commodity:	*Metric tons*
Copper sulfate	15, 133
DDT	3, 000
Dinitro orthocresol	1, 200
BHC	500
Copper carbonate	400–500
Colloidal sulfur	300
Lead arsenate	300
Nicotinol	100
Nicotine concentrate	30

Each of the above commodities is produced by one firm only, with the exception of copper sulfate (three), and dinitro orthocresol (two).

Copper sulfate is manufactured from domestic copper and sulfuric acid; output is limited chiefly by availability of copper. Lead for lead arsenate and nicotine are available, but dinitro orthocresol concentrate is imported, as are lindane and some DDT concentrate. Most Yugoslav pesticides are compounded or packaged domestically. Several firms are engaged either in negotiations for license to manufacture other pesticides, or in test production. Manufacture of parathion by three plants began in 1954, and one firm is making mercury dusting powder under license from Bayer (Germany).

Consumption

Official consumption figures for 1952, estimated consumption of pesticides in 1953, and projected consumption for 1960 are given in table 54.

Foreign Trade

See table 55 for foreign trade data. Copper sulfate has been a substantial export item since before World War II, and Yugoslavia has productive capacity to supply considerably more. Output depends on price of copper sulfate relative to the price of copper, and exports have dropped during the past few years to about half the 1950 level. Except for small quantities of copper carbonate, other pesticides are not presently exported, although it is expected that DDT preparations will soon enter the foreign market. Near Eastern and South American countries have shown interest in obtaining Yugoslav pesticides and it is expected that as the country's productive capacity grows there will be an exportable surplus of additional commodities.

Foreign exchange difficulties have prevented import of pesticides in quantities needed and, as a result, the Yugoslav chemical industry

Table 54.—*Yugoslav Consumption of Pesticides, 1952 and 1953, and Projected Use in 1960*

[Metric tons]

Commodity	1952 actual	1953 estimated	1960 projected
BHC (benzene hexachloride)	500	120	500
Colloidal sulfur	300	32	100
Copper carbonate	400–500	20	3, 000
Copper sulfate	14, 000	9, 000	16, 000
Cyanides	n. a.	n. a.	20–30
DDT	3, 000	365	1, 140
Dinitro orthocresol	1, 200	130	2, 550
Lead arsenate	300	50	2, 000
Mercury powder	n. a.	102	550
Nicotine	10	15	10
Nicotinol	100	n. a.	----------
Parathion	n. a.	17	140–150
Sulfur	3, 000	3, 000	3, 000
Sulfur dioxide	n. a.	n. a.	50
Zinc phosphide	n. a.	n. a.	10

n. a. Not available

Source: Federal Plant Protection Service (1952 and 1953); Ten-Year Plan for Agricultural Development (1960).

is attempting to make licensing arrangements with foreign firms for manufacture of pesticides needed to meet domestic demand.

Equipment

Lack of adequate equipment is one of the serious handicaps to use of all pesticides. In particular, there is a shortage of portable sprayers for use in vineyards. There was no production of these sprayers during or immediately after World War II, although three small independent factories are now manufacturing about 20,000 units a year. An additional factory in Maribor is making a small motor sprayer, about 700 having been produced. Attempts to interest large farm machinery producers in manufacturing suitable types of spraying and dusting equipment have so far met with no success. Some equipment was imported under British aid in 1953. The most urgent needs are for hand dusters, small portable motor dusters, light motor sprayers, and fog sprayers for the olive groves.

Marketing and Distribution

Imports are made by direct purchase. The normal course of distribution is approval of the product by the Bureau of Plant Protection, then sales through local representatives or visiting agents directly to Yugoslav commercial outlets.

Advertising by United States firms would be of no value unless the firm were represented by a Yugoslav agent. The agent would know how best to bring the products to the attention of Yugoslav farmers,

Table 55.—*Yugoslav Foreign Trade in Pesticides, 1954*

Commodity classification and principal countries of origin or destination	Quantity (pounds)	Value (U. S. dollars)
EXPORTS		
Copper sulfate:		
Hungary	881, 840	$77, 285
Turkey	315, 699	32, 487
USSR	2, 204, 843	198, 096
All other countries	33, 730	1, 324
Total	3, 436, 112	309, 192
IMPORTS		
Plant protection preparations:		
France	65, 711	4, 323
Switzerland	17, 659	2, 916
All other countries	6, 668	4, 669
Total	90, 038	11, 908
Insecticides, etc.:		
Austria	68, 475	4, 503
Belgium and Luxembourg	42, 659	2, 950
Germany, West	229, 750	117, 252
Netherlands	281, 303	168, 996
Switzerland	45, 992	9, 056
United Kingdom	562, 261	169, 960
All other countries	5, 732	1, 613
Total	1, 236, 172	474, 330
Disinfectants:		
Netherlands	53, 133	18, 521
United Kingdom	237, 551	37, 273
All other countries	7, 508	3, 767
Total	298, 192	59, 561
Grand total, imports	1, 624, 402	$545, 799

Source: Yugoslav official trade statistics.

whether through advertising and demonstrations or by conducting direct negotiations with the Bureau of Plant Protection, which agency is in general charge of pest control and is the key to distribution of pesticides in general.

Government Decrees and Regulations

Control of pesticides is under the Basic Law on Protection of Plants from Diseases and Pests, published in Official Gazette No. 26, June 23, 1954. Regulations under this law are promulgated from time to time.

Prospective Developments and Trends

Under the Yugoslav law, no United States capital can be put into equity investment in the country. Technical assistance to the pesticide industry would be very valuable, but should be fitted into the general program of Point IV technical assistance.

United States manufacturers desiring a share of the Yugoslav market should appoint alert and capable local agents, preferably visiting the country to select the agent and also to acquaint themselves with local conditions. One large United States firm has a representation agreement with a Yugoslav firm and is negotiating for an agent. Providing suitable dusting and spraying equipment also would doubtless improve chances of success in entering the Yugoslav pesticide market. Although it seems doubtful that the Yugoslav economy will permit sizable pesticide imports in the immediate future, the government is increasingly aware of the problems of agriculture and is now making credit available to individual farmers, as well as to state farms and cooperatives, for buying equipment. Technical authorities are anxious to improve both the quality and amount of pesticides used and demand for these products may increase. In time, the Yugoslav market may become important, especially for licensing arrangements and the sale of concentrates.

Asia and Oceania

Except for production in Australia and Japan, and a few plants in other areas, pesticides are not manufactured in Asia and Oceania. This area remains the third largest export market for United States pesticides, with India and the Philippines the major market.

AUSTRALIA

(Based on report by R. J. Dorr, U. S. Consulate General, Sydney)

Production

Australia is largely self-sufficient in the production of pesticides, except for specialized commodities, many of which are imported from the United States.

Principal manufacturers of basic chemicals for pesticides are Imperial Chemical Industries of Australia and New Zealand, Ltd. (a subsidiary of the British concern), Monsanto Chemicals (Australia) Ltd. (a subsidiary of the United States firm), and Timbrol, Ltd., an Australian company. Eighteen or twenty additional firms formulate various pesticides. Production data on individual items are not available and overall volume is reported only on a value basis. *Manufacturing Industries, 1952–53,* No. 3, *Chemicals, Drugs and Medicines,* Commonwealth Bureau of Census and Statistics, states "Production of disinfectants and all pesticides in the fiscal year 1952–53 (April 1–March 31) was valued at $12,898,000." This is a considerable increase over the $4,203,943 output reported for 1949–50.

In general, Australian production of pest-control products is based on domestic raw materials. Principal exceptions are white arsenic, imports of which totaled 2,244 long tons ($283,212) in 1953–54, and pyrethrum flowers, 140 long tons ($124,922). The usual procedure is to import new pesticides for testing and adapting to Australian conditions, then inaugurate domestic production if possible.

No government subsidies for production of pesticides have been granted. The prevailing tariff schedule and exchange control and import licensing systems have protected domestic manufacturers.

Consumption

Official consumption data are not available. Information acquired from the three principal manufacturers forms the basis for the following estimates of average annual use:

Commodity:	*Long tons*
Benzene hexachloride	500–600
DDT	500–700
2,4–D	400–600
2,4,5–T	200
Dithiocarbamate fungicides	250
Parathion	20–40
Phenothiazine (for worm infestation in sheep)	500–1, 000
Sodium chlorate	100
Lead arsenate	500
Copper fungicides (mostly copper sulfate and copper oxychloride)	1, 000–1, 500
Sulfur	700
White oil	700

Projected consumption of pest-control products is extremely difficult to estimate. Benefits derived from application of pest-control products are well known and use is widespread. Total consumption is expected to increase in the next 5 years, but consumption of particular items will vary according to needs and development of new or better products. For example, nicotine sulfate has been largely replaced by phenothiazine, and lead arsenate usage fell off with the advent of DDT. Likewide, the hormone-type herbicides have tended to supplant arsenic and sodium chlorate for weed control.

Foreign Trade

Australian imports of pesticides have been principally new products which, when tested and adapted to local conditions, have been produced domestically if the size of the market warranted. The United States, followed by the United Kingdom, has been the principal source for new products. Such basic raw materials as pyrethrum and arsenic also must be imported. New Zealand is the principal destination for exports, which totaled $510,000 in 1953–54. It is not expected that the foreign trade pattern will change in the near future.

Due to a chronic shortage of dollar exchange, Australia has comprehensive and detailed exchange control and import licensing systems governing dollar imports. There is no dollar allocation for imports of pesticides; each import application is "considered on its merits," which means that approval will be granted only if the pesticide is not available domestically or from other nondollar sources.

Equipment

Australian farms are relatively well mechanized and the past few good crop years have resulted in increased use of mechanical farm equipment. Australia manufactures a variety of dusting and spraying equipment and thus is not entirely dependent on imports of these commodities.

Marketing and Distribution

Domestic producers of basic pest-control chemicals generally sell to other firms which compound branded products for wholesale distribution. A similar distribution pattern is followed for imported products. Because of the exchange-control system, it is not possible to make comparisons as to price and quality among United States, other foreign, and domestic pest-control products.

Table 56.—*Australian Foreign Trade in Pesticides, 1953–54* [1]

Commodity and country of origin or destination	*Value (U. S. dollars)*
IMPORTS	
Lead arsenate: United Kingdom	12, 105
Copper sulfate:	
United Kingdom	134, 340
Other countries	722
Total	135, 062
Benzene hexachloride:	
France	1, 270
Germany	30, 240
Netherlands	71, 920
Union of South Africa	9, 590
United Kingdom	15, 900
Total	128, 920
Fly papers	3, 150
Nicotine spraying preparations	7, 920
Rotenone spraying preparations	740
Insecticides and disinfectants, not elsewhere included:	
Germany	30, 010
United Kingdom	119, 400
United States	24, 475
Other countries	890
Total	174, 775
Washes and dips in liquid or powder, arsenical:	
United Kingdom	33, 585
Washes or dips in liquid or powder, non-arsenical:	
United Kingdom	12, 915
Other countries	240
Total	13, 155
Weed, scrub, and tree killers	9, 375

See footnote at end of table.

Table 56.—*Australian Foreign Trade in Pesticides, 1953–54—Con.*

Commodity and country of origin or destination	*Value (U. S. dollars)*
IMPORTS—Continued	
Pyrethrum flowers, including pulverized:	
Kenya	99, 820
Tanganyika	24, 300
Other countries	780
Total	124, 900
Grand total	643, 687
EXPORTS	
Copper sulfate	1, 290
Benezene hexachloride	6, 495
Nicotine spraying preparations	675
Other insecticides and disinfectants, not elsewhere included:	
Australian territories	51, 280
Hong Kong	26, 180
Malaya	50, 890
New Zealand	56, 500
Pacific Islands	21, 540
Other countries	23, 770
Total	230, 160
Washes and dips (sheep, cattle and horse), liquid and powder	10, 560
Weed, scrub, and tree killers:	
New Zealand	254, 810
Other British countries	15, 100
French Associated States and Dependencies	215
Total	270, 115
Grand total	519, 295

[1] April 1–March 31.

Source: Australian official statistics.

Government Decrees and Legislation

Each Australian state has a pest-control product act which requires the registration of such products with a state organization, usually the Department of Agriculture. (A list of pest-control products registered in the state of Victoria—representative of commodities registered in the other states—is on file in the Chemical and Rubber Division.)

Prospective Developments and Trends

Because of exchange restrictions, the United States share of the Australian market probably will not increase. In the event full sterling convertibility is attained, United States products might have a price advantage, at least until protectionist policies eliminate the spread between cost of United States products and those from the United Kingdom or other nondollar areas.

Although the use of pest-control products is increasing, the rate of increase is diminishing. The past 5 years have seen a doubling of domestic production. However, local trade contacts believe that the initial period of raising production to meet domestic needs is over. Therefore, it would appear that the best opportunity for United States manufacturers lies in production in Australia, either through licensing an existing manufacturer or by establishing a subsidiary. The local acceptance of a new pest-control product would be a most propitious opening for introduction of an additional manufacturing facility. The availability of basic raw materials would be the principal problem facing a new producer.

BURMA

(Based on report of J. H. Boulware, U. S. Embassy, Rangoon)

Production

No pesticides are manufactured in Burma nor are any raw materials for their production available in appreciable quantities. Compounding and packaging operations by a local druggist involve preparation of DDT and BHC emulsions for retail sale but are insignificant on a national scale.

Consumption

Burma is a potential market for pesticides but is not of great importance as an immediate outlet. Insecticides comprise the great bulk (probably 95 percent or more) of all pesticide imports and are used primarily for public health and sanitary purposes. Agriculture is potentially a large consumer but at present only small amounts of DDT and BHC are used on crops. Virtually no effort is made to control pests of stored grain and each year large losses occur from infestations. Extensive use of pesticides is likely to require several years of education and experience. A serious handicap is the tradition against destroying life (including insect).

Primary consumers of insecticides are the army and navy (40 percent), public health services (30 percent), the general public (15 percent), agriculture (10 percent), and the Burma railways (5 percent).

A spokesman for the Army Medical Service reports that requirements for the defense services are 19,000 imperial gallons of 25 percent DDT emulsion, 29,000 pounds of 75 percent DDT powder, 1,000 gallons of 20 percent BHC emulsion, and about 12 tons of 6.5 percent gamma content, water-soluble BHC. Central Medical Stores reports that annual requirements, primarily for malarial control work, are about 50 tons of 75 percent DDT. The Department of Agriculture states that peanut growers use about $2,000 worth of DDT a year for insect control.

Foreign Trade

Principal imports, primarily from British sources, are DDT, BHC, mosquito repellants, and various household sprays for use against flies and mosquitoes. In 1955 United States exports of pesticides to Burma consisted entirely of DDT, 25 percent and over, and totaled 706,000 pounds, valued at $237,000. This total varied only slightly from that in 1954.

Until recently, Burma purchased virtually all pesticides from the United Kingdom. As a part of the foreign aid program, United States DDT was used in malarial-control work. However, because of the shortage of dollars, nearly all commercial purchases are from sterling or soft-currency sources. Compilations from the Rangoon Daily Customs List show imports in the first 6 months of 1954 of DDT valued at $17,850; insecticides, $3,000; and "disinfectant fluid," $8,600. Also, 500 cases (size unknown) of DDT were imported from Italy and 17 cases of "insecticides" from West Germany. A local importer reports that the DDT from Italy was for the army and that prices were more favorable than those of the United Kingdom.

Insecticides are imported on open general license from the sterling area, but require import licenses when obtained from the United States or other dollar areas.

Equipment

Only simple spraying equipment is used in Burma, such as hand-operated units for spraying houses or breeding places of mosquitoes in malarial-control programs.

Table 57.—*Imports of Pesticides into Burma, 1953*

Commodity and Country of Origin	Value (U. S. dollars)	Commodity and Country of Origin	Value (U. S. dollars)
Copper sulfate:		Disinfectants—Continued	
United Kingdom	6, 975	Japan	405
India	910	United Kingdom	109, 660
		United States	85, 060
Total	7, 885	West Germany	1, 020
		Other	1, 340
Disinfectants:			
Belgium and Luxembourg	8, 365	Total	214, 355
India	8, 505		
		Grand total	222, 240

Source: Burmese official statistics.

Marketing and Distribution

The major distributor of insecticides in Burma is the Imperial Chemical Industries (Export) Ltd., a United Kingdom firm. Several

other firms have local agents who import on letters of credit from producers abroad and sell to the government as well as to the retail trade. Oil companies import limited quantities of sprays for fly and mosquito control. Trade sources report that prices for United States products are slightly lower than for those of British or European origin, but lack of dollar exchange precludes imports from the United States on a more substantial basis.

Government Decrees and Legislation

There are no known government controls or regulations affecting production and distribution of pest-control products.

Prospective Developments and Trends

In the foreseeable future, it is doubtful that Burma will offer an opportunity for investment of United States capital or technical knowledge for the manufacture of pesticides. As the country develops, the market should increase and, unquestionably, herbicides and fungicides, as well as additional insecticides, will find a place in the Burmese economy. However, indications are that a number of years will be required before these products will be used sufficiently to warrant establishment of a manufacturing plant.

To cut down losses in stored grain and beans, the government is considering a program of insect control, but has set no time for its initiation. Most storage is under control of the State Agricultural Marketing Board, Rangoon, which probably would purchase insecticides for use in any such program.

CEYLON

(Based on report by E. Fernand, U. S. Embassy, Colombo)

Production

No pesticide industry exists in Ceylon (1954). On the whole, Ceylon's requirements for pesticides are imported; however, a fungicide, used in tapping rubber trees, is locally manufactured under the name "Candarsan." Ingredients of this compound have not been clearly defined and often imported products are preferred.

A DDT-caustic soda-chlorine factory is being erected at Parantham, about 210 miles north of Colombo, by the government with assistance from UNICEF and World Health Organization. The government has voted 11 million rupees ($2.3 million) for establishment of this factory; plant equipment valued at $400,000 will be contributed by

UNICEF and WHO. The factory is scheduled to go into production in the latter part of 1955, and annual estimated output is 500 tons of technical DDT.

Consumption

Statistics on consumption of individual pesticides are not available, but major use is by agriculture on tea, rubber, and coconut plantations. In the past, the Ceylon Government health services consumed about 325 short tons of technical DDT each year in control of malaria. However, with the success of this program, annual use is now down to about 200 tons. The filariasis-control program annually uses 90 tons of 5–15 gamma BHC, 500 gallons of 2,4-D amine salt, and 500 gallons of Teepol 410 (chemical composition not known).

A principal local dealer reports that about 90 percent of fungicides imported are various copper compounds used for controlling blister blight on tea. Some imported insecticides are used to combat various pests on rice and a small amount against insects attacking tea, but the major portion of insecticides is used by government health authorities. All sulfur imported is used for dusting rubber trees against oidium attack.

As oidium in rubber and blister blight in tea are being extensively controlled, import figures will probably remain fairly constant for fungicides, but for weedkillers and insecticides will undoubtedly increase.

The Department of Agriculture fumigates plants and fruit imported into Ceylon, as well as rice and other cargo from plague-infested areas. Cocoa exports, particularly to the Philippines and Australia, also are fumigated before shipment. Hydrogen cyanide is the principal material used for fumigation purposes and in 1953 about 8,000 pounds were consumed.

Principal pesticides used locally are DDT and BHC formulations, copper fungicides, and sulfur dusts. Other pesticides consumed are dieldrin, aldrin, toxaphene, chlordane, endrin, and malathion.

Foreign Trade

Ceylon's requirements for pesticides are filled primarily by the United Kingdom. Other important suppliers in the past 2 years have been Italy, Canada, and West Germany. In the period January–August 1954, the United Kingdom supplied 4,315,000 pounds, principally fungicides, and 1,232,000 pounds of sulfur was imported from Canada. The United States was the principal supplier of insecticides in the first 11 months of 1954.

Table 58.—*Ceylon Imports of Pesticides, 1954*

[Value only—converted to U. S. dollars]

Countries of origin	Insecticides	Fungicides
Commonwealth countries and British possessions:		
India	8, 130	1, 380
Singapore	2, 730	----------
Union of South Africa	2, 630	----------
United Kingdom	65, 000	725, 000
Other	235	50
Total	78, 725	726, 430
Foreign countries:		
Germany, West	1, 040	10, 590
Switzerland	2, 960	106, 740
United States	355, 360	505
Other	570	25
Total	359, 930	117, 860
Grand total	438, 655	844, 290

Source: Ceylon official statistics.

Equipment

The Ceylon Director of Agriculture states that lack of suitable and adequate spraying and dusting equipment is a major limiting factor in the use of pesticides. Appropriate types of equipment have been tested and evaluated but, because of high cost, the average Ceylonese cultivator cannot afford them. The government is establishing a pool of equipment, furnished by Canada under the Colombo Plan, which can be hired by cultivators at nominal rates.

In early 1954, over 2,000 acres of rubber were sprayed by helicopter to combat oidium—a costly experiment which proved no more effective than spraying from the ground.

The Department of Agriculture is experimenting with new machinery for spraying and dusting paddy (rice) against pest attack. A low-volume power sprayer known as a mist blower (operated from the shoulders of an operator) has been tried out using DDT emulsion concentrates against paddy leafhoppers and swarming caterpillars. Almost complete control is reported to have been achieved.

Marketing and Distribution

Distribution of pest-control products is through local agents who also are wholesalers and retailers. Most Ceylonese firms buy on irrevocable letters of credit. Firms having long-established relations with foreign concerns may receive credit. The Department of Health Services buys through tenders from various countries. The lowest bid is accepted provided the insecticide conforms to WHO standards.

The chief advertising media are local press and trade journals, but motion pictures and commercial radio programs also are utilized.

Government Decrees and Regulations

There are no regulations currently affecting production or distribution of pest-control products, but the government is contemplating a regulation embodying some features of the United States Insecticide, Fungicide, and Rodenticide Act and the United Kingdom Agricultural Poisons Act.

Prospective Developments and Trends

Demand for agricultural insecticides is growing because of the increased areas under cultivation, the government's food-production drive, current experimentation with new methods by the government and planting industries, and the trend toward modernization of agriculture. A considerable need for rodenticides exists in all seaports, transportation centers, and large storage places. The government has allocated 5 million rupees ($1,052,600) for construction of warehouses which will add 130,000 tons of storage space to the 180,000 now available and provide storage space for 4 million bushels of rice.

The Rubber Research Institute of Ceylon states that a market exists for a good grasskiller costing less than $10.50 per acre; such a product would have wide application on rubber estates. The Institute has been in touch with United States and other foreign firms regarding this matter.

Although United States pesticides compare very favorably with imports from other sources, prices are higher. Also imports of pesticides from the United States and other foreign countries are dutiable at 10 percent ad valorem, whereas similar products from British Commonwealth countries are admitted free of duty.

Judging from the following extract from the speech of the Ceylon Minister of Industries in the Senate on September 16, 1954, there is an opportunity for foreign investment and technical knowledge in Ceylon:

> We would like to see new lines of production and industries where special types of experience and technical skill will be developed and where domestic production is either wanting or in very small supply at the moment. The best form of foreign investment I consider should be the supply of capital goods, technical knowledge and the use of foreign patents.

FORMOSA (TAIWAN)

(Based on report by J. W. VanderLaan, U. S. Embassy, Taipei)

The island of Formosa is separated from the Chinese mainland by less than 100 miles. Only 24 percent of its 13,885 square miles is cultivated agricultural land. The principal crops are rice, sweet potatoes, tea, and sugarcane.

During the Japanese occupation, pest control was not developed and methods were often ineffective. In 1950, efforts to correct this situation were undertaken by the Joint Commission on Rural Reconstruction (a Chinese-American organization). During the past 4 years JCRR has attempted to educate farmers in the use of proper pesticides and to demonstrate the benefits to be derived through pest control. From July 1, 1949, through December 31, 1953, JCRR used the following pesticides in demonstrations:

	Metric tons
10 percent DDT	350
Tobacco waste	297
Lead arsenate	223
Calcium cyanamide	100
Tribasic copper sulfate	142
Derris powder	70
Lime-sulfur	29

Production

The government-owned and operated Taiwan Agricultural Chemical Works, Kaohsiung, is the principal producer of pesticides in Formosa, manufacturing both DDT and BHC. Production of DDT in 1951–53 was as follows (in metric tons):

	1951	*1952*	*1953*
100 percent technical	124	88	118
75 percent wettable	----	----	106
10 percent powder	555	266	55

Capacity for production of DDT is much greater than actual output, which depends on local demand. A goal of 575 metric tons of 100-percent DDT was established for 1954, including 500 tons of 75 percent wettable for the WHO malarial program. All raw materials for manufacture of DDT and BHC are imported.

The Taiwan Agricultural Chemical Works and the Taiwan Alkali Company manufacture BHC, the combined output being about 600 metric tons a year of BHC up to 90 percent gamma content, sufficient to meet local needs. About 180 tons a year of rotenone insecticides are manufactured from locally grown derris root. A small quantity of nicotine is produced by the TACW. Pyrethrum powder, made from domestically grown pyrethrum, is used in the manufacture of joss

sticks and mosquito repellant. TACW produces resin-soda and lime-sulfur mixtures. The Chinese Petroleum Corporation has developed a summer oil which has been used successfully in combating armored scale-insects in fruit orchards.

Consumption

Production data indicate consumption of DDT and BHC. In 1953 successful experiments were made with "Folidol" (a German phosphatic insecticide) for control of rice borers. Additional supplies of Folidol were ordered in 1954. Other phosphatic pesticides have been imported and tested, but consumption has been limited to experimental use. Small amounts of 2, 4–D, warfarin, and DD mixture have been imported but are not extensively used.

In 1952, a 4-year, island-wide malaria eradication program with DDT residual house spraying was adopted under WHO, aimed at protection of 150,000 people in 1952 and 1,500,000 in 1953.

Foreign Trade

In 1953 imports of insecticides and disinfectants totaled 112 metric tons, valued at $108,000. Detailed statistics are unavailable. The United States was the principal source, followed by the United Kingdom, Japan, Hong Kong, West Germany, and Australia. During that year FOA-financed imports of pesticides were valued at $25,529.

Equipment

Requirements for sprayers and dusters increase proportionately with use of pesticides. In 1952 JCRR procured 5,200 sprayers and 800 rotary hand dusters from Japan. The Provincial Food Bureau and JCRR jointly bought 520 hand-operated semiautomatic sprayers and 520 rotary dusters of local manufacture in 1953. These have not proved entirely satisfactory but efforts are being made to improve the quality. The first consignment of 85 motor-driven sprayers, imported from the United States under the ICA (then FOA) procurement program, arrived in Formosa in 1954 and have been distributed in various districts for demonstration purposes.

Because of the low purchasing power of the Taiwanese farmer, market for mechanical equipment will be limited and purchase and distribution of sprayers and dusters will be concentrated in the farmers associations, the Provincial Department of Agriculture and Forestry, and the Provincial Food Bureau. National corporations, such as the Taiwan Sugar Corporation, Taiwan Pineapple Corporation, and Taiwan Tea Corporation, obtain equipment for their own use through regular commercial channels.

Marketing and Distribution

Most pest-control products and equipment have been introduced through efforts of JCRR and distributed to farmers through local associations. There are practically no wholesale distributors, and retailers carry only small stocks of household insecticides. Traditionally, farmers favor Japanese products until extensive demonstrations prove the superiority of new United States products.

Under present foreign-exchange regulations all commercial imports are on a letter-of-credit basis. The import duty on insecticides, disinfectants, and the like is 22½ percent ad valorem.

Besides ICA procurement on behalf of JCRR and Chinese Government purchases through the Central Trust of China, commercial sales are made through registered importers.

The outstanding advertising medium for reaching the Formosan farmer is *Harvest*, a biweekly farm journal jointly sponsored by JCRR and the U. S. Information Service and having 38,000 paid subscribers. Its address is HARVEST, 1, Section 1, Chi Nan Road, Taipei.

Government Decrees and Regulations

There is no legislation or regulations affecting production and distribution of domestic and imported pesticides. Generally speaking, foreign exchange is not made available for imports of products manufactured locally in sufficient quantities for domestic needs. In view of the urgent need to increase agricultural production, every encouragement is given to farmers to use pesticides to reduce crop loss from insects and disease.

Prospective Development and Trends

The limited size of the Formosan market for pest-control products necessarily restricts opportunities for United States capital investment in this field. Brochures and sales literature on new products and methods, particularly for control of pests on the principal crops, and offers of free demonstrations through JCRR, farmers associations, and other organizations would seem to be the most effective methods for developing the market for United States pesticides.

INDIA

(Based on material on file in Chemical and Rubber Division)

The use of pesticides in South India was until 1911 largely confined to a few large-scale coffee, tea, and rubber plantations. Arsenicals were the chief insecticides used and were viewed by farmers with

suspicion because of toxicity. The inception of a Department of Agriculture in Madras and the publicity conducted by that Department have increased the popularity of modern insecticides in South India. Although much progress has been made in use of pesticides on such commercial crops as acrecanut (used as a vermifuge for control of tapeworms, particularly by veterinarians), tobacco, and coconut, their use on most fields crop is still limited by economic conditions. At present, South India's entire requirement of pesticides is met by imports from Bombay State and foreign countries.

Production

At a cost of $189,000, the Mysore Fertilizer Company recently installed the first two modern insecticide-formulating plants in South India, one in Madras and the other in Kuppam, Andhra State, with monthly production capacity of 500 and 200 tons, respectively. The plants will formulate insecticides, rodenticides, and fungicides based on DDT, BHC, lindane, toxaphene, chlordane, aldrin, dieldrin, and endrin, with initial technical collaboration from Gerdau India Corporation, Inc., New York, N. Y. According to the American representative, the Kuppam factory already has gone into production (May 1955) and the Madras plant was scheduled to go on stream shortly after June 1, 1955. Some raw materials are imported from soft-currency countries, but specialized products are imported from the United States under import licenses. These two plants are expected to meet a major portion of South India's requirements for formulated pesticides, thus greatly reducing imports.

Recent Indian press reports indicate that the government is planning to set up a second DDT factory in Alwaye, Travancore-Cochin, with capacity of 1,400 tons of DDT per year, at an estimated cost of $1,570,000. The first government-owned DDT factory, with annual capacity of 700 tons, was erected near New Delhi, with the assistance of the United Nations International Childrens Emergency Fund and the United Nations Technical Assistance Administration. Capacity of this factory was expected to be doubled by the end of 1955.

Alkali and Chemical Corporation of India, Ltd. began manufacturing BHC at Rishra in 1952. Capacity of this plant is 1,500 tons a year (gamma content unknown). Tata Chemicals has established a plant for producing BHC in western India. Alkali and Chemical Corporation produces chlorine, and benzene is available from Indian sources. Total requirements for BHC are stated to be 2,500 tons a year.

Consumption

Consumption data are not available. Although agriculture is a large consumer of pesticides, the principal use, particularly for DDT, is for public health purposes.

Foreign Trade

Official statistics on Indian imports of pesticides are unavailable, but there is a large market for United States pesticides.

INDONESIA

(Based on report by C. W. Snider, U. S. Embassy, Djakarta)

Production

Modern synthetic pesticides are not manufactured in Indonesia. In 1954, an estimated 10 tons of locally grown derris (approximately 8 percent rotenone) was processed and about 50 tons of pyrethrum flowers were grown. A small quantity of sulfur is processed for use as fungicides. Imported concentrated products are compounded domestically.

Two factories, located in Bandung and Solo, process derris. Several small firms manufacture a mosquito repellant consisting of a short coil of slow-burning sawdust containing 5 percent pyrethrum. A small DDT factory is reportedly being established near Surabaja. There are also several Chinese-owned firms which bottle a household insecticide consisting of DDT in a petroleum solvent.

Sufficient derris and pyrethrum are grown locally, but all other raw materials and toxic ingredients for production of pesticides are imported.

Consumption

Estimated 1954 consumption of pesticides was as follows:

Household insecticides (toxic ingredients are lindane, BHC, and 5 percent DDT)	gallons	350,000
Derris (8 percent rotenone)	metric tons	20
DDT (75 percent)	do	2,500 (1,500 agricultural, 750 public health, 250 household)
Dieldrin	do	15 (public health)
Pyrethrum	do	100

The following figures represent consumption of private tea estates on Java and Sumatra (in metric tons):

DDT (50 percent)	450
Copper oxychloride	750
Sulfur	2,000
Miscellaneous insecticides (BHC, dieldrin, etc.)	50
Two trade-marked products, consisting of DDT in a coal-tar base	450

Government requirements are estimated as approximately 50 percent of those of private consumers.

Foreign Trade

Indonesian imports of pesticides over the past 3 years have shown a slow but steady increase. DDT compounds rose from 1,744 metric tons in 1952 to 2,375 tons in 1954. The United States has been, and probably will continue to be, the principal source for Indonesia's imports of pest-control products.

Exports of Indonesian pyrethrum and derris have dropped to negligible proportions. Derris production for export is now considered a "dead" industry, but there is a possibility for development of pyrethrum for world markets.

Equipment

Present condition of spraying and dusting equipment is unsatisfactory, mainly because import restrictions make its replacement and the acquisition of modern equipment difficult. Portable knapsack sprayers are in better supply because of ICA imports of some 2,500 units a year for use in the antimalarial campaign. A small factory in Jogakarta, almost the exclusive supplier of well-made locally built insecticide sprayers (copied from a Japanese patent), reports it has many unfilled orders because of lack of brass sheets. Estates are increasing use of mechanical equipment, but small landholders have little equipment because of the cost factor.

Marketing and Distribution

Outside of government procurement, there is keen competition in the BHC and DDT markets. United States pesticides compare favorably with those of other supplying countries, principally the Netherlands and the United Kingdom. The Netherlands is particularly competitive with regard to materials for use on the large estates.

Countries other than the United States sell to Indonesia on direct purchase contracts. Czechoslovakia exported about 135 metric tons of pesticides to Indonesia in 1954 under a bilateral trade agreement.

Channels of distribution, in order of relative importance are: Local agents, foreign company representatives, ICA, government agencies,

and United Nations agencies. Commercial firms attempt to maintain stocks of pest-control products, particularly those for estate use, but under present conditions, imports usually are made on the basis of contracts from the estates. Imports of packaged household pesticides are almost entirely by two petroleum companies which arrange distribution to retail outlets through large wholesaling firms.

Government Decrees and Legislation

There are no specific government laws or regulations affecting the production and distribution of pest-control products.

Prospective Developments and Trends

Present opportunities for United States capital and technical knowledge in Indonesia's manufacture of pest-control products are doubtful. Pyrethrum processing has some promise of future development, possibly with the help of foreign investment.

The United States share of Indonesia's pesticide market is expected to increase in the next few years, principally because of ICA procurement for public health use. For instance, proposed imports from the United States for this purpose in 1956 are 2,800 metric tons of DDT and 100 tons of dieldrin. In the agricultural field, where competition is keenest, consumption of pesticides is expected to decline as foreign estate owners leave, although increased use of these products by small Indonesian landholders will compensate for some of this loss.

Recommendations for further improving the competitive position of United States products are: Appointment of capable local representatives, with good connections in agricultural circles and among appropriate government agencies; increased promotional work, including field demonstrations; more United States company participation in, and identification with, procurement under assistance programs.

IRAN

(Based on report by H. C. Lint, U. S. Embassy, Tehran)

Except for locust-control work, which is entirely a government operation, and the mosquito-control work undertaken in 1951 under Point Four, control of insects is in the experimental stage.

Production

The principal pesticide manufactured in Iran is agricultural sulfur. Present capacity is 150 tons, but two other plants under construction will increase production to 450 tons a year. Crude sulfur is recovered

at Abadan in the oil-refining process. A small quantity of copper sulfate is manufactured. The only sulfuric acid plant is operated by the Iranian Army where copper sulfate is produced from locally smelted copper. Data on output are unavailable but it is believed to be small. The National Iranian Oil Company annually manufactures from 200,000 to 250,000 gallons of fly spray under the name "IMSHI."

Consumption

The major portion of pesticides consumed in Iran is by the locust control agency and the public health agency of the government. In both cases actual insecticides are furnished by the Operating Mission, with the exception of some BHC locust bait supplied by Soviet Russia in the past 2 years. The principal household insecticide is a kerosene-pyrethrum spray which is not considered as effective as well-known United States brands. Prospects are that use of pest-control products will increase very slowly.

Foreign Trade

Statistics on imports of pesticides are not available, but estimates of total imports of these products are:

	Metric tons
DDT (100 percent basis) (used primarily for mosquito control)	1, 000
BHC (largely for locust poison)	100
Parathion	10

Equipment

Only knapsack and pump-type household sprayers are manufactured in Iran; both types are of rather unsatisfactory workmanship. The Operating Mission has imported several hand-operated types of United States sprayers for demonstration work. At present, the need for knowledge of benefits to be derived from pesticide applications is greater than that for equipment.

Marketing and Distribution

The few merchants handling imported pesticides, mainly from the United States or Switzerland, buy for cash. As western European countries, particularly Germany, strive to obtain a greater share of the Iranian market, some sort of credit basis may be established.

By far the greatest portion of imported pesticides is distributed through the Operating Mission for Iran.

Government Decrees and Regulations

Pesticides for agricultural use are imported duty free. No inspection service exists and the only assurance of obtaining a quality product is the reputation of the manufacturer.

Prospective Developments and Trends

While United States products have a good reputation in Iran, possibilities for increased sales will depend upon further demonstrations on effectiveness of the materials; better education of farmers on use and advantages of pest control; alertness of the Iranian representative of the United States manufacturer; and better credit terms to compete with other sources for pest-control products.

In addition, United States manufacturers should package their products more substantially for shipment to Iran. They might also offer color charts on insects and methods of control to the Ministry of Agriculture for forwarding to "county agents" so trade names of products and name of manufacturer may become familiar to potential users of such products. However, reform and modernization of agriculture in Iran are likely to be slow.

IRAQ

(Based on report by Elwyn F. Chase, U. S. Embassy, Baghdad)

Production

Pesticides are not produced in Iraq. A household insecticide, "ISHMI," is imported in bulk from the United Kingdom by the Khanaqin Oil Company for local bottling, but this is a small operation. Iraq produces both petroleum and sulfur, but no plans exist for manufacturing pesticides from these materials.

Consumption

The principal pesticides consumed in Iraq in 1953 were as follows:

BHC: 115 metric tons (Ministry of Agriculture, 100; private sales, 15). Used for locust baiting and control of date palm leafhopper.

Aldrin: 15 metric tons—used for locust control.

DDT: 125 metric tons (Ministry of Health, 117; Ministry of Agriculture, 6; private sales, 2). Used for fly and mosquito control and the sunn pest.

"ISHMI": 50 tons. (This product consists of DDT and pyrethrum in a refined petroleum-base product.)

In addition to the above products, the following pesticides, now imported in negligible quantities, are believed to have good prospective consumption:

Chlordane: For control of ants, cockroaches, and termites.

Dieldrin: Used experimentally for date palm leafhopper and may replace BHC for this purpose.

Endrin: Used experimentally for spiny bollworm.

Malathion: Used experimentally for control of the sunn pest.

Parathion: Used for control of the sunn pest.

Warfarin: For control of rats and mice.

Weedkillers: There is believed to be a good future market for weedkillers, but extent of potential demand is unknown.

According to information obtained from an ICA entomologist, potential demand for the above products is very large. However, future use will depend on results of research and possible shift from one product to another for specific control measures.

Foreign Trade

There are no separate tariff categories for pesticides, and specific data on imports of these items are unavailable. Pesticide distributors claim that imports have steadily increased in recent years. The United Kingdom is the principal source for imports, the United States the second.

Equipment

Lack of spraying and dusting equipment handicaps use of pesticides to some extent, but the major limiting factor is lack of awareness of Iraqi farmers in pest-control methods. Equipment currently in use, even hand sprayers and dusters, is exclusively of British origin except for two United States Piper Cub airplanes. The Iraqi Government plans to buy four more Piper Cubs in the near future.

Marketing and Distribution

The Iraqi Government can be expected to remain the major purchaser of pesticides for the present, because of the need for further education of farmers in use of such products. Advertising is a minor factor in promoting sales to the government, as purchases are on the basis of the lowest bid for comparable materials. However, for new or superior United States products, technical and descriptive literature would be useful in getting the product story across to government agencies. Such literature should be sent to the Ministries of Health and Agriculture and to the Central Foreign Purchasing Board, Ministry of Finance, all in Baghdad.

Newspaper advertising should be moderately successful in reaching

the educated large landholder, but would not be effective with most small farmers because of the high rate of illiteracy.

The principal channels of distribution are:

Sales agents, for sales to distributors and large users.

Iraqi subsidiaries of foreign manufactures, for sales to distributors and large users.

Ministries of Health and Agriculture, for government requirements for public health and agriculture.

U. S. Operations Mission, Baghdad, for public health and agricultural needs.

British manufacturers' terms are direct sale. The Iraqi Government buys through the Central Foreign Purchasing Board if the amount exceeds $2,800; if less, the Ministry concerned buys direct. The largest supplier of pesticides for both government and private use is Imperial Chemical Industries, which does business through an Iraqi branch office.

Government Decrees and Regulations

There are no regulations affecting the production and distribution of pest-control products, either domestic or imported. Imports from hard-currency countries (including the United States) require import licenses, which are not difficult to obtain for products essential to agriculture.

Prospective Developments and Trends

The Ministry of Health is considering the manufacture of DDT, but there are no other known plans to produce pest-control products. Present volume of consumption does not warrant manufacture, and unless additional basic raw materials are produced, domestic manufacture of pest-control products seems remote.

Impetus for increased use of pesticides is provided by the Iraqi Government which, however, still has a lot of pioneering work to do. Its program is largely in the experimental stage except for the locust campaign, which is well organized and has been successful.

Expansion in the Iraqi market probably will be slow. Iraq is in the sterling area and United States products generally cost more than British. ICA experts in agriculture and health programs help to acquaint Iraqis with United States pesticides, but promotion of sales is an individual company problem. It should be approached by the appointment of good sales agents or distributors by factory representatives who first visit Iraq and study the market sufficiently to understand its problems and potentialties. United States manufacturers should be prepared to take a long-term view and to work closely and patiently with their local agents. Any further increase in foreign business probably will be by firms that are well represented by distributors who have had a hand in market development.

ISRAEL

(Based on report by C. Haut, U. S. Embassy, Tel Aviv)

Production

Domestic manufacture of pest-control products has so far been limited to about 10 factories compounding and formulating imported toxic ingredients. Some of these plants also produce petroleum oils and weedkillers from imported raw materials. Present annual output of petroleum oils containing 80 percent oil is estimated at 2,500 metric tons a year and is consumed almost entirely by the citrus industry.

Production in early 1955 of DDT (100 percent), copper oxide, and 2,4-D was scheduled by Makhtashim, Ltd., in three plants at Beersheba. Electro-Chemical Industries (Fruitarom) Ltd., Haifa, was expected by the end of 1955 to inaugurate its plant for manufacture of caustic soda, chlorine derivatives, and various insecticides.

Makhteshim's DDT plant, built under an agreement with J. R. Geigy of Basle, will have an annual capacity of 350 metric tons, which will supply all of Israel's needs. The copper oxide plant has annual capacity of about 750 tons. The third plant will manufacture 2,4-D and capacity will exceed domestic requirements. Makhteshim is already producing chlorine at a rated capacity of 1,000 tons a year, about half of which is needed for Makhteshim use, while the rest will be marketed. Ethyl alcohol for the manufacture of DDT is produced locally, but copper for copper sulfate must be imported. Kaolin clays required as fillers for formulated pesticides come from deposits in the Negev at from 6,000 to 7,000 metric tons a year. It is estimated that not more than 20 percent of raw materials for production of the above pesticides will be imported.

Makhteshim's production program for the first year is as follows:

	Metric tons
DDT (100 percent)	200
Copper oxide	200
2,4-D	50–100
Paradichlorobenzene	10
Parachlorophenol	50

Makhteshim also has a formulation plant which already markets DDT, aldrin, dieldrin, nicotine, lindane, and sulfur insecticides.

Although the Israeli Government is desirous of promoting domestic manufacture of pest-control products, as well as compounding and formulating, to conserve foreign exchange and develop local industry, no direct subsidies are granted to pesticide producers. Formulating and compounding activities are estimated to have resulted in a foreign exchange saving of $500,000 in 1954.

Consumption

Current annual consumption of pesticides in Israel is estimated at 5,000 metric tons ($1 million), of which over 90 percent is believed to be used for agriculture. The detailed breakdown below is based largely on trade sources since official figures are not available.

Estimated 1954 Consumption of Pesticides and 1955 Requirements

[Metric tons]

Product	1954 consumption	1955 requirements
Petroleum oils	2, 500	3, 500
Sulfur	1, 500	2, 000
Cryolite	300	300
DDT (100 percent)	150	50
Copper oxide	100	65
Copper sulfate	50	40
Dithane	30–40	40
Methoxychlor	20–30	65
Nicotine sulfate	30	40
2,4-D	20	13
Endrin	20	40
Lindane	15	3
Dieldrin	15	8
Ethylene dibromide	15	8
Aldrin	14	n. a.
Lead arsenate	10	13
Other	17	8

Source: Plant Protection Division, Ministry of Agriculture.

Israeli trade sources are of the opinion that consumption in 1960 will be double that in 1954, although what commodities will be in general use at that time is not known since many products now consumed might be replaced by newer types.

Foreign Trade

Official statistics on imports of pesticides into Israel are unavailable. Principal suppliers in 1954 were the United States (40–50 percent), West Germany (30 percent), and the United Kingdom (15 percent), with lesser quantities from Sweden, Denmark, and the Netherlands. Since the beginning of 1954, the United States has been the supplier for specialized materials and sulfur; West Germany the leading source for copper oxides, copper sulfate, lindane, and ethylene dibromide; and the United Kingdom for BHC, 2,4–D, lead arsenate, nicotine sulfate, and copper sulfate. The inauguration of domestic production of various pesticides probably will result in reduced purchases from West Germany while imports from the United States and the United Kingdom should remain at a high level.

Exports of pest-control products from Israel are planned to a number of countries. Small quantities have already been shipped, such as

DDT to Cyprus and petroleum oils and processed sulfur to Turkey. Among other possible export markets envisaged are Greece, Yugoslavia, Italy, Spain, and East Africa.

Equipment

The Ministry of Agriculture and distributors of plant-protection materials and of farm machinery have stated that, while there is lack of certain small spraying and dusting equipment and accessories, it constitutes no serious deterrent to the overall use of pesticides.

Marketing and Distribution

Regular channels of distribution are importers, local agents, and foreign company representatives. Sales of pesticides usually are in conjunction with other agricultural chemicals and supplies. Purchases from West Germany are handled through the Reparations Company in Tel Aviv. Terms of sale usually are on a cash basis against letter of credit. The prevailing shortage of ready cash, on the other hand, forces Israeli distributors frequently to sell on 3 to 6 months' credit. The Ministry of Finance usually channels requests for imports to countries where prices are lowest and/or to those for which foreign exchange is available.

Current advertising media (newspapers) appear inadequate. There is need for such media as field demonstrations and film exhibitions. Trade sources indicate that packaging pesticides in smaller containers might be of benefit in stepping up sales.

Government Decrees and Regulations

Domestic manufacture of all pest-control products, sales of both local and imported materials, and selection of pesticides to be imported are rigidly controlled by the Plant Protection Division of the Ministry of Agriculture. The Division prohibits sale of new pesticides without prior registration and approval and controls local distribution of numerous approved items. (A copy of the Plant Protection Rules of 1950 is on file in the Chemical and Rubber Division.)

The excellent research work being done by the Plant Protection Division, agricultural experiment stations, and the Hebrew University, together with that carried out in the laboratories of the Ministry of Health and a few large producers, is a major factor in the steady increase in pesticide consumption. The Plant Protection Division and its staff of entomologists promotes the use of about 150 registered pest-control products through publications and the dissemination of detailed instructions on many pest-control problems.

Prospective Developments and Trends

The Israeli market for pesticides is limited by both population and geographic factors. United States capital has played a large part in the establishment of the two plants which were to begin production in 1955, but further investment at this time does not seem advisable unless exclusively for export. Opportunities may exist for licensing arrangements with basic chemical plants which could be adapted to include specific pesticide materials.

United States pesticides compare favorably with those of other suppliers in both quality and price. With initiation of domestic manufacture, imports are expected to fall off and this may have some impact on Israeli purchases of United States pesticides. Nevertheless, the trade believes that United States firms can hold their present position and, so far as the more highly technical, newer products, and raw materials are concerned, possibly increase their sales by an effective advertising campaign and, when feasible, by extending credits to Israeli importers and distributors.

JAPAN

(Based on report by G. E. R. Meyer, U. S. Embassy, Tokyo)

The Japanese pesticide industry is well developed and can supply much of the country's requirements. However, lack of adequate basic research results in dependence on outside sources for newly developed materials which may be superior to those now employed in Japan.

Although pesticides have been used for many years in Japan, only since World War II has there been wide acceptance for use on rice and other staple food crops. After World War II, the Japanese Government granted subsidies of 30 to 40 percent of the cost to farmers purchasing pesticides for protection of staple food crops. In 1954, this subsidy was reduced to 10 percent. To offset the decrease, prices of popular agricultural pesticides have been reduced as domestic production expands. Many pest-control products formerly imported are now manufactured locally in quantities sufficient to meet all domestic requirements.

Production

Except for mercury compounds used for disinfecting grain and seed potatoes, most prewar pesticides in Japan were of simple composition. The introduction of dust-form pesticides, such as DDT, later BHC and still more recently, parathion, and new uses for mercury compounds changed the entire picture for the Japanese pesticide industry.

In 1954, about 290 tons of parathion, out of total requirements of 500 metric tons, was produced, and total demand will be met from domestic production in 1955. Production of MCP (methyl chlorophenoxyacetic acid) was inaugurated in early 1954, and later that year manufacture of calcium cyanide (formerly imported from Germany) was begun.

Table 59.—*Japanese Production of Pesticides, in Finished Form, 1953–54*

[Metric tons]

Commodity	Calendar year 1953	Pesticide year 1954
Agricultural:		
BHC (12 percent gamma equivalent):		
Dust	26, 562	21, 400
In emulsion	95	180
For water solution	807	700
With pyrethrum	271	100
Calcium arsenate	957	1, 000
Copper sulfate	4, 500	4, 600
Copper and copper-mercury compounds	4, 252	3, 500
Derris dust	189	170
DDT:		
Dust	966	1, 100
In emulsion	900	750
For water solution	341	500
With pyrethrum	271	600
Lead arsenate	1, 443	2, 350
Lime sulfur	10, 665	11, 700
Mercury compounds (seed disinfectants)	947	750
Mercury compounds, dust	7, 289	24, 000
Methyl bromide	274	400
Parathion	Not made	10, 580
Pyrethrum	118	320
Oil emulsions	4, 790	4, 300
Rosin-caustic soda mixture	259	270
2, 4–D	298	500
Other	186	620
Total agricultural	66, 380	90, 390
Public health and household:		
BHC:		
Dust	4, 307	Not available.
For solutions	2, 213	
Camphor preparations	240	
DDT:		
Dust	733	
Petroleum solution	4, 914	
Powder for water solution	24	
Emulsion	122	
Naphthalene (repellant)	3, 080	
Paradichlorobenzene	1, 400	
Pyrethrum:		
Coils	1, 400	
Emulsion	750	
Phosphorus rodenticides	78	
Total, public health and household	19, 261	

Sources: Agriculture—Japanese Agricultural Pesticides Industry Association, 1953; Ministry of Agriculture and Forestry, 1953–54 estimates. Public health and household—Ministry of Welfare. 1954 data not available.

Consumption

Use of pesticides in Japan began around 1920 and until the middle 1930's was limited largely to protection of fruits, vegetables, and tea. Later, and particularly since World War II, consumption increased considerably with the acceptance of DDT, BHC, and other organic products, as well as a willingness to substitute newer pesticides as they were developed. More interest is shown now in rodent control and means for protecting forests against insects and disease.

Consumption is determined to a large extent by the outbreak of crop diseases. For instance, in 1953 the Japanese rice crop suffered from outbreaks of rice blast and rice stem borers. The Japanese Ministry of Agriculture and Forestry experimented in 1954 on a pest-control program in farm communities in order to ensure greater safety measures as well as proper timing and uniformity of application. (See table 60 for consumption of pesticides in 1951–54 and projections for 1960.)

Foreign Trade

Japan's requirements of derris and cube roots are imported on an automatic-approval basis. Such roots formerly were received in shredded form from Formosa, Belgian Congo, Peru, and Malaya, but powdered cube root of high uniform quality is now imported from the United States. Normally, 60 to 70 tons of nicotine sulfate is imported annually to supplement nicotine obtained from waste leaf supplied domestically.

All imports are subject to availability of foreign exchange. Thus, importation of pesticides manufactured locally is not normally allowed unless there is a domestic shortage. Importation of new pesticides is permitted in quantities sufficient to allow examination and thorough experimentation. If found acceptable, the new pesticide is registered by the Ministry of Agriculture and Forestry as suitable for importation and local sale and foreign exchange is allocated in amounts sufficient for practical trial. When possible, only concentrated forms of pesticides are imported. The Japanese pesticide industry is reported anxious to find a suitable substitute for parathion, which is considered too highly toxic for safety. The importation of the newer pesticides varies greatly from year to year, dependent to a large extent upon their acceptance by the Ministry of Agriculture and Forestry and the public. As domestic production of leading pesticides develops, it is anticipated that imports of raw materials and intermediates will increase and those of finished pesticides decrease.

Japan is not a large exporter of pesticides, although certain products have traditionally been exported. Prominent among these are pyrethrum flowers and other pyrethrum products, naphthalene, and camphor. Immediately following World War II, Japan also exported

Table 60.—*Japanese Consumption of Pesticides, in Finished Form, 1951–54 and 1960*

[Metric tons]

Commodity	1951	1952	1953	1954 (Estimated)	1960 (Estimated)
Agricultural:					
BHC:					
Dust	10, 322	23, 899	25, 305	20, 000	25, 000
In emulsion	61	77	92	100	100
Powder (water soluble)	365	964	657	700	1, 000
BHC-pyrethrum mixture	74	136	129	100	100
Calcium arsenate	700	431	643	600	600
Copper sulfate	4, 000	4, 000	4, 500	4, 600	5, 000
Copper-mercury compounds	1, 929	3, 137	4, 237	3, 200	3, 500
Derris preparations	76	108	234	220	150
DDT:					
Dust	686	954	850	800	500
In emulsion	516	858	825	750	500
Powder (water soluble)	350	393	322	300	200
DDT-pyrethrum mixture	74	141	259	300	200
Lime-sulfur	12, 000	12, 000	10, 665	11, 700	10, 000
Lead arsenate	1, 630	1, 335	1, 400	1, 500	1, 500
Mercury compounds (for seed disinfectants)	243	448	625	420	750
Mercury compounds, dust	----	32	6, 487	18, 000	25, 000
Nicotine sulfate	88	126	94	80	50
Oil emulsions	2, 371	3, 356	3, 980	4, 000	4, 000
Methyl bromide	51	136	205	150	300
Parathion	----	435	7, 816	10, 200	20, 800
Pyrethrum	134	40	81	120	40
Rosin-caustic soda mixture	388	210	269	250	200
2,4-D	143	146	260	300	900
Zineb (a dithiocarbamate)	----	30	217	450	1, 100
Other	16	102	77	208	450
Total, agricultural	26, 217	53, 494	70, 229	79, 048	101, 940
Public health and household:					
BHC:					
Dust	----	----	4, 307	5, 100	8, 000
For solutions	----	----	2, 213	2, 800	3, 500
Camphor insect repellent	----	----	240	250	300
DDT, dust and other preparations	----	----	5, 793	6, 000	7, 000
Naphthalene	----	----	3, 074	3, 050	4, 100
Paradichlorobenzene	----	----	1, 000	900	2, 000
Phosphorous rodenticides	----	----	78	85	100
Pyrethrum coils	----	----	1, 400	2, 000	2, 000
Pyrethrum in emulsion	----	----	750	600	600
Total public health and household	----	----	18, 855	21, 785	27, 600

Source: Agricultural—Japanese Agricultural Pesticides Industry Association. Public health and household—Ministry of Welfare. 1951 and 1952 data not available.

DDT and BHC. Mercury seed disinfectants were formerly exported to Manchuria and Korea, but these markets no longer exist. The high cost of some raw materials and delay in improving techniques and introduction of new pesticides, as well as failure to keep pace with development in other countries, have contributed to lack of export markets. Exploiting a strong domestic demand for pesticides has proved easier than attempting to establish foreign markets.

Table 61.—*Japanese Imports of Pesticides, 1950–54*

[Metric tons]

Commodity	1950	1951	1952	1953	1954 [1]
Nicotine sulfate	49	69	70	70	60
Derris and cube root	90	30	108	104	45
Parathion	------	------	70	120	231
EPN (ethyl-p-nitrophenyl thiono-benzene phosphonate)	------	7	30	27	34
DD (dichloropropene-dichloropropane)	100	------	------	------	53
TEPP (tetraethyl pyrophosphate)	------	------	36	------	------
Malathion	------	------	------	1	17
Zineb (a dithiocarbamate)	------	------	25	306	400
2,4-D (all types)	7	20	15	------	------
Calcium cyanide	------	------	------	21	59

[1] January–September only.

Source: Ministry of Agriculture and Forestry.

Japan hopes that new and larger foreign markets may be established in Southeast Asia as a result of introduction of Japanese agricultural techniques to those countries. Since the government reduced its consumer subsidy, there has been some concern among pesticide manufacturers about the need to increase exports.

Equipment

The shortage of adequate pest-control spraying and dusting equipment is said to be a major limiting factor in pest-control work, particularly in forest areas. Probably the most adaptable equipment for use in Japan is 2- to 2.5-horsepower mobile sprayers and 1.2-horsepower portable dusters. Sprayers retail at about $280 and portable dusters at $125, hence this type of equipment is usually purchased by agricultural cooperatives or villages.

The government hopes to alleviate the shortage of spraying and dusting equipment in the next few years by granting consumer subsidies and making direct purchases. During 1954, $600,000 was budgeted for this purpose.

Marketing and Distribution

Japan imports pesticides from European countries as well as from the United States. Imports usually are made by agents and distributed by wholesaler-manufacturers. Such concerns may produce certain pesticides as well as compound and repack imported materials for distribution through their own sales networks.

Registration of a new pesticide by the Japanese Government for sale and use is based on recommendations by experimental stations which also are responsible for explaining use of these new products to consumers. Trade agreements and allocations of foreign exchange also determine sources of supply.

Effective advertising alone is not sufficient to establish a market for a new pesticide in Japan; favorable reports by national and prefectural agricultural experiment stations are essential. Therefore, it would appear advisable that representatives of United States producers be given liberal sample amounts for testing purposes and complete instructions on use of the material.

Government Decrees and Regulations

A number of important government regulations control manufacture of and trade in pesticides. The Agricultural Chemicals Regulations Law (Law No. 82, July 1, 1948) requires registration with the Ministry of Agriculture and Forestry of all agricultural pesticides manufactured, imported, or processed for local sale. All containers must show registration number, ingredients, directions for use, place of manufacture, etc. That law also outlines other governmental control measures over registered agricultural chemicals.

The Law for Control of Poisonous and Powerful Agents (Law No. 303, December 28, 1950) requires registration of manufacturers, importers, and dealers handling "poisonous" and "powerful" agents and outlines methods to be used for marking containers and coloring the pesticides for easy identification. The following are listed as major "poisonous" and "powerful" pesticides:

"Poisonous" pesticides: Phosphorous rodenticides, cyanide fumigants, mercury and copper-mercury compounds, nicotine preparations (more than 10 percent nicotine), arsenate preparations, Fratol (sodium fluoroacetate), TEPP, parathion, EPN.

"Powerful" pesticides: Zinc sulfate, sodium chlorate, potassium chlorate, alkalis (containing 6 percent or more caustic soda), chloropicrin, copper compounds, nicotine powder (nicotine 10 percent and less), carbon disulfide, barium carbonate, formalin, derris preparations (rotenone more than 2 percent), methyl bromide.

Cabinet Order (No. 28, February 22, 1952) Concerning the Handling of Sodium Fluoroacetate and Cabinet Order (No. 95, May 18, 1953) Concerning Handling of Parathion limit these pesticides to agricultural and forestry uses. The Orders also provide for proper marking, methods of application, and disposal of containers, and specifically provide that Fratol and parathion shall be used only by authorized organizations, such as the national government, municipalities, and agricultural cooperatives under the guidance of an authorized technician.

The Plant Quarantine Law (No. 151, May 4, 1950) designates certain plant pests and diseases considered harmful (rice blast, rice leaf blight, rice planthopper, rice stem borer, black rice bug, rice leaf miner, rice leaf beetle, wheat and barley rust, mildew, scab, and snow blight) and outlines measures to be taken for forecasting and control-

ling their outbreak. The law also provides for a government subsidy, limited to 50 percent of the cost, to purchase pesticides, sprayers, dusters, fumigators, and the like necessary to control these insects and plant diseases.

The Pharmaceutical Affairs Law (Law No. 197, July 29, 1948) stipulates that the Ministry of Welfare must approve the manufacture, importation, and sale of pesticides for household and public health and welfare use.

Prospective Developments and Trends

Japan will depend on imports of new pesticides and techniques until basic research is improved. There appears to be a real attempt to become self-sufficient in the supply of pesticides. For this reason, it may be expected that patent license and technological agreements concerning new and effective pesticides will be welcome.

Cultivation of a market in Japan for United States pesticides, therefore, depends on the introduction of new products more effective than those now in use. Because of low-income level, low-cost pesticides are most popular, especially those suitable for diseases and insects affecting staple crops.

LEBANON

(Based on report by K. Salam, U. S. Embassy, Beirut)

Production and Consumption

No pest-control products are manufactured in Lebanon and production is not anticipated in the near future.

Official statistics on consumption of pesticides in Lebanon are not available. Below are estimates secured from trade sources.

Product:	*Annual consumption (thousands of pounds)*
Sulfur compounds	662–772
DDT	110–121
Spray oils	88–110
BHC compounds	44–55
Lead arsenate	44–55
Parathion compounds	15–22

About 100,000 pounds of DDT and all BHC compounds imported are consumed for public health and household purposes. Consumption of pest-control products is on the rise and this trend probably will continue. Responsible factors are: Increasing awareness of Lebanese farmers of benefits to be derived from use of pesticides; expansion of agriculture; improved facilities for obtaining and using pesticides; and general improvement in the farmers' income level.

Foreign Trade

The principal sources for Lebanese imports of pesticides are the United States, the United Kingdom, France, Belgium, and Germany. For the past 4 years imports from the United Kingdom, France, and Belgium have been decreasing, whereas imports from the United States have risen.

Between 7 and 10 percent of Lebanon's imports of pesticides are reexported, about two-thirds going to Jordan and the remainder to Syria, Iraq, Saudi Arabia, and Kuwait.

Equipment

Spraying and dusting equipment is in adequate supply in Lebanon, but small farmers often lack credit facilities to obtain it.

Marketing and Distribution

With the exception of imports from German sources, which sell on credit terms of 3 to 12 months, pesticides are imported on direct-purchase terms. The only foreign distributor of pesticides is British Imperial Chemical Industries. All other distributors are local agents and, with the exception of one in Tripoli (Lebanon), are located in Beirut. Most Lebanese farmers purchase pesticides direct from agents in Beirut. Some large farmers act as intermediates between the agent and small farmers and often extend credit.

Advertising is carried out by local agents, some of whom organize trips to agricultural areas, carry on demonstrations, and try to popularize control of insects and diseases on agricultural crops.

On the whole, United States pesticides rank first in quality but in general are higher priced than products from other countries. To promote sales of their products, United States firms should appoint able and active local agents, equip them with adequate advertising material, and absorb a portion of the costs of demonstrations and similar activities.

Government Decrees and Regulations

No special legislation or regulations govern or affect production and/or distribution of pest-control products in Lebanon.

Prospective Developments and Trends

With the exception of petroleum, raw materials for production of pesticides are not available locally and a domestic industry is not indicated. High cost of United States pesticides, compared with that of products from other countries, is a deterrent factor in increased

participation in the Lebanese market. The competitive position of United States products could be improved by extending credit whenever practicable. Beirut is a natural geographic center for trade between the West and other Arab countries, and United States firms might consider establishing stocks of pesticides in Lebanon from which to supply other Middle Eastern countries. The Beirut Free Zone probably could be used for formulation of pesticides from active ingredients shipped from the United States, thereby reducing costs for finished products.

NEW ZEALAND

(Based on report by Elaine D. Smith, U. S. Embassy, Wellington)

Production

There is virtually no New Zealand production of toxic ingredients used in the manufacture of pesticides. The industry is confined to processing of imported toxic materials by addition of fillers, wetting agents, and the like. With few exceptions raw materials are imported. The latest published production data for pesticides, for the year ended March 31, 1953, show production (formulation) of industrial and household pesticides at 940,975 pounds, valued at $113,325; and pesticides for agricultural and horticultural use, 581,950 pounds, valued at $149,570.

The Farmers' Fertilizer Company, Ltd., Auckland, produces copper sulfate, but not enough to meet requirements. With the exception of clays, copper scrap, and packaging materials, all pesticide requirements are imported, mainly from sterling sources.

There are no government subsidies to pesticide formulators, but an import duty protects them from foreign competition.

Consumption

Consumption of copper sulfate is about 200 long tons a year; of technical DDT, 140 tons. About 50 tons of cube root are imported each year. Consumption data on other products are not available.

According to the trade, outlook for increased consumption of pest-control products is good. The number of companies either specializing in or giving increased attention to marketing pesticides has increased from 4 to 10 in the past few years.

Foreign Trade

Under New Zealand's program to reduce dollar expenditures, imports of goods from the United States are controlled by a licensing

program. Principal supplying countries are Australia and the United Kingdom. The 1955 Licensing Schedule classifies "wettable sulfurs" and "insecticides and fungicides for agricultural uses" as goods for which applications for license to import will be considered on their individual merits.

In 1950 about 16 percent of pesticides imported into New Zealand were of United States origin; in 1951, 11 percent; in 1952, about 6.2 percent; and in 1953, slightly more than the 1952 level. The tariff on United States pesticides is 3 percent.

Table 62 shows value of New Zealand imports by classifications and countries of origin for 1952 (latest available data).

Table 62.—*Imports of Pesticides into New Zealand, 1952*

Classification and Country of Origin	Value (U. S. dollars)	Classification and Country of Origin	Value (U. S. dollars)
Insecticides and fungicides:		Weedkilling preparations:	
United Kingdom	293, 734	United Kingdom	89, 857
Australia	110, 042	Australia	536, 239
West Germany	44, 898	Belgium	63, 650
United States	29, 554	West Germany	20, 880
Other	5, 966	Other	13, 522
Total	484, 195	Total	744, 200
Lead arsenate:		Copper sulfate:	
United Kingdom	43, 948	United Kingdom	256, 693
Australia	59, 424	Australia	132, 244
Other	646		
Total	104, 018	Total	388, 937
Nicotine sulfate:		DDT:	
United Kingdom	50, 075	Australia	4, 706
Other	9, 391	United Kingdom	51, 805
		Japan	175, 000
Total	59, 466	United States	47, 450
		Total	278, 961
Sheep dip:			
United Kingdom	715, 400		
Other	2, 338		
Total	717, 738		

Source: New Zealand official statistics.

According to available statistics, exports of all pesticides from New Zealand totaled $11,905 in 1952. It is not anticipated that this trade will increase.

Equipment

Generally speaking, there is adequate spraying and dusting equipment, much of it domestically produced. Any special type not locally available may be readily imported from the sterling area.

Marketing and Distribution

New Zealand formulators consider United States pesticides superior in quality to those from other sources and prices are competitive. The principal deterrent to higher United States imports is the exchange situation.

Terms of sale for imports of pesticides are direct purchases by letters of credit. Distribution is generally by local agents.

Government Decrees and Regulations

Conditions of sale, packaging, and labeling of poisons are covered by the Poisons Act, 1934, and the Poisons General Regulations, 1937, with amendments, administered by the Health Department. In addition, the Departments of Agriculture and Scientific and Industrial Research (part of the Department of Industries and Commerce) operate a service known as the "Certification of Therapeutants" in which insecticides and fungicides are tested under New Zealand conditions and are certified if certain requirements are fulfilled.

Prospective Developments and Trends

Under present circumstances, little opportunity exists for investment of United States capital and technical knowledge in the domestic manufacture of pest-control products.

The New Zealand Government is gradually relaxing exchange and licensing restrictions, and imports from the United States should be more easily obtained. Since finished pest-control products are manufactured, it is doubtful that imports of these commodities will increase; but since New Zealand is dependent on imports of toxic ingredients for preparation of finished pesticides, United States exporters should have an opportunity to compete in the New Zealand market for concentrated materials.

PAKISTAN

(Based on report by A. W. Dias, U. S. Embassy, Karachi)

Insect-control measures in Pakistan constitute one of the most practicable methods for increasing much-needed food production. A conservative estimate places losses from insects and disease at 10 percent in agricultural crops and much more in fruit yield.

Production

A DDT plant was recently erected at Nowshera, Northwest Frontier Province, by the Pakistan Industrial Development Corporation with the assistance of the United Nations. It is expected that initial pro-

duction will be 200 metric tons a year, which will gradually be increased to 700 tons. At present, Pakistan is entirely dependent on imports to meet its requirements of pesticides.

The Government of Pakistan does not grant subsidies to any industry. However, in order to encourage investment in industrial development, local manufacturers are granted various concessions, such as a 5-year exemption of 5 percent of capital investment from super-tax and income tax on profits of industrial undertakings established prior to April 1, 1955; exemption of these profits from business-profits tax; and exclusion of capital goods and essential raw materials from import duties.

Consumption

Locusts are a major menace to agricultural crops in West Pakistan. Control of breedings in that area, in addition to international efforts to destroy this pest in Arabia, Afghanistan, India, and Iran, has averted huge losses. Infected areas are sprayed with aldrin or baited with BHC-impregnated rice dust under the supervision of the Department of Plant Protection, which has an Anti-Locust Organization equipped with motor transport, control equipment, and aircraft. ICA also has been operating one to three planes in Pakistan in demonstrations of locust control.

The Plant Protection Department coordinates fruit and crop pest-control projects which are conducted by the various provincial departments of agriculture. Control of sugarcane pyrilla on some 8,000 acres in the Northwest Frontier Province has resulted in a 20 percent increase in sucrose content in addition to substantially larger yields. Similarly, fruit production has risen with use of pesticides.

Recent large-scale attempts have been made to control the rice stem borer in Sind and Punjab and the rice jassid in Sind. In 1954, efforts also were made to control cotton pests.

About 90 percent of DDT consumed in Pakistan is used for public health purposes; other commodities are used for protection of agricultural crops. Official statistics on consumption are not available. Foreign Operations Administration (now ICA) estimates for 1953 are as follows:

Commodity:	*Metric tons*
DDT	1,035
BHC	58
Sulfur	25
Aldrin	20
Grain fumigants	20
Other	11

Assuming an upward trend in the development of new arable land, it is believed that use of pesticides will quadruple by 1960.

Foreign Trade

Pakistan's economy does not permit a large investment in pesticides. Because of a limited supply of exchange, commercial imports of various commodities, including pesticides, are not at present permitted from dollar areas.

Pesticides imported privately are not sufficient to meet requirements, and supplemental supplies and equipment are furnished by the International Cooperation Administration.

Official data on Pakistan imports of pesticides are not available.

Equipment

Lack of adequate equipment is one of the most serious handicaps in the use of pesticides in Pakistan. There is a large demand for good portable power sprayers for use on fruit and vegetables in Punjab, Northwest Frontier Province and Baluchistan.

Marketing and Distribution

Distribution of pesticides is usually effected through local agents, foreign company representatives, and the Government Plant Protection Department.

Pakistan firms must have import licenses before foreign purchases are made. These firms promote sale of their products through advertisements in local newspapers and trade journals and by actual demonstrations.

The quality of United States pesticides is considered equal to, if not better than, that of European products. However, lower prices and import restrictions cause importers to obtain much of their requirements from European sources.

Government Decrees and Regulations

The pesticide industry is governed by the same general regulations as other industries, such as participation of indigenous capital in industries established by foreign investors, tariff protection, and tax concessions.

Prospective Developments and Trends

In view of the country's predominantly rural economy, the promotion of industries which increase agricultural yields is one of Pakistan's main aims.

Current fiscal policy is intended to provide an incentive to private enterprise and investment in industry. Priority is given to import

of capital goods and raw materials required for the expansion of industry. Technical and financial aid from various countries has helped to establish certain basic industries. United States technical knowledge and know-how could be used to good advantage by Pakistan pesticide manufacturers.

Because of import restrictions and lack of dollar exchange, the outlook is not good for increased pesticide markets in Pakistan. United States Government-sponsored exports, particularly for public health purposes, probably will continue.

PHILIPPINE REPUBLIC

(Based on report by H. V. Geib, U. S. Embassy, Manila)

Production

Practically no pest-control products are manufactured in the Philippine Republic. Rotenone and nicotine are produced in insignificant quantities by a few farmers and by the Bureau of Plant Industry (for work at its experimental stations).

Consumption

The Bureau of Plant Industry has been the most important consumer of pesticides. In addition to ICA supplies, the Bureau imports pest-control products direct from foreign exporters. Consumption is greatest on agricultural crops. Besides pest-control products brought in by ICA and the Bureau of Plant Industry, reliable trade sources estimate that 300 metric tons of agricultural pesticides and 250 tons of household insecticides were imported by local firms in 1953. The Department of Health consumed 1,418,124 pounds of DDT powder for malaria control in the fiscal year 1953–54, all of which was supplied by FOA. Large quantities of warfarin and Pival were used in the rat-eradication campaign, particularly in Mindanao.

Trade sources indicate that by 1960 use of pesticides probably will quadruple 1953 consumption. Since 1951, use of pesticides has steadily increased, due largely to realization that control of insects and plant diseases is a potent factor in raising volume and lowering costs of agricultural production. The serious infestation of rats in the Mindanao area, presence of armyworms and rice stem borers in most parts of southern Luzon, and the infestation of locusts in some Visayan islands and Mindanao, made the government and private individuals more conscious of the problems of control.

The budget for fiscal year 1954–55 provided for an ordinary expenditure of $229,080 and extraordinary expenditure of $1 million for intensification of the campaign for control and eradication of agricultural pests and diseases, including rats.

Foreign Trade

According to the Bureau of Census and Statistics, value of Philippine imports of pesticides was approximately 108 percent more in 1953 than in 1952. Approximately 80 percent came from the United States, 2 percent from Japan, 1 percent from the United Kingdom, and 17 percent from other countries.

At the beginning of import control in 1949, volume of pesticide imports was small, so little provision was made for these products in the Import Control Law. Most pest-control products have been brought in under the ICA-Philcusa (Philippine Council for U. S. Assistance) program and under allocations for miscellaneous chemicals. With the expected decrease in ICA-Philcusa imports, the Philippine Republic Act No. 1175 was enacted on June 18, 1954, to include pest-control products among commodities exempted from payment of the 17-percent exchange tax.

Philippine statistics on pesticides imported in 1953 are shown in table 63.

Table 63.—*Philippine Imports of Pesticides, 1953*

Import Classification and Country of Origin	Quantity (pounds)	Value (U. S. dollars)
Insecticides:		
Belgium	55, 000	3, 110
Germany	94, 700	30, 309
Hong Kong	81, 685	10, 791
Japan	57, 928	14, 565
Netherlands	47, 085	24, 198
Switzerland	23, 078	7, 054
United Kingdom	42, 365	11, 764
United States	970, 255	287, 388
Total	1, 392, 116	389, 179
Fungicides:		
United Kingdom	3, 672	1, 226
United States	35, 980	12, 777
Total	39, 652	14, 003
Disinfectants:		
Canada	2, 378	816
Germany	53, 240	3, 359
Japan	22, 000	1, 825
United Kingdom	17, 085	2, 516
United States	790, 024	161, 378
Total	884, 727	169, 894

Source: Official statistics of the Republic of the Philippines.

Equipment

Lack of equipment is a deterrent to the use of pest-control products, especially by small farmers who cannot afford to buy necessary

sprayers and dusters. Spraying and dusting equipment received by the Bureau of Plant Industry through ICA is far from sufficient.

Trade sources indicate that portable spraying and dusting equipment of about 2½-gallon capacity is the ideal type and size for Philippine farmers. This type is priced locally at $17.50 to $22.50.

Marketing and Distribution

Pest-control products are imported and distributed through three main channels—Government agencies, ICA, and local importers. Free insecticides from ICA tend to keep commercial volume small but also encourage a larger potential market. Government distribution is limited to various government headquarters, while commercial supplies can be purchased at village stores.

Government and ICA purchases are made by public bids or direct purchase, whereas imports by commercial establishments are on a credit basis. Pesticides also are distributed through foreign subsidiaries.

Government Decrees and Regulations

Insecticides and rodenticides come under the "Essential Producer" category of the Central Bank with regard to priority in allocating dollars for payment of imports.

No regulations exist on distribution of pesticides, but the Bureau of Plant Industry gives priority for their shipment to areas threatened by pests or diseases.

Prospective Developments and Trends

At present there are no plans for manufacture of pesticides in the Philippines. It would appear that opportunity exists for United States investment in the local manufacture of these products.

The present administration is attempting to develop rural areas, in which damage by plant pests and diseases poses a serious problem. According to estimates of the Bureau of Agricultural Extension, the rice stem borer alone caused a loss of approximately $40 million in the 1953–54 crop year. Kadang kadang (disease of coconut) is said to have destroyed over 5½ million coconut trees in 1953, resulting in decreased exports of $175 million and a loss of government revenue amounting to $3,750,000.

The abaca industry faces a real crisis from mosaic disease. Onion culture in Luzon in 1953 was almost a complete failure because of purple blotch disease. Coffee rust, potato blight, scab, mango leafhopper, cornborer, leaf spot disease, pythium root rot, Fiji disease on sugarcane, and many other pests and diseases annually take their toll from field and vegetable crops. Until these pests and diseases

are controlled and complete eradication of rats in Mindanao and other infested areas is accomplished, the Philippines will require a large supply of pest-control products.

SYRIA

(Based on report by M. Thompson and M. Bakhash, U. S. Embassy, Damascus)

Production

Syrian production of pesticides is limited to a very small output of nicotine sulfate by the Tobacco Monopoly (Regie) and repackaging of imported toxic ingredients.

Consumption

Sulfur is the principal pesticide consumed in Syria and is used primarily for protection of grapes around Damascus. Consumption has risen steadily in recent years to an estimated total of 400 metric tons in 1953.

The large expansion in cotton planting in 1952 and the heavy insect infestation occurring that year resulted in importation of 4,200 tons of cotton dust (3–10–40—3 percent BHC, 10 percent DDT, and 40 percent sulfur). Cotton acreage reduction during 1953, combined with lighter infestation, resulted in greatly reduced consumption and a carryover into 1954 of about 2,000 tons of cotton dust. The Agricultural Bank, the sole importer, purchased no cotton dust in 1954 and 1955 stocks are estimated at about 1,500 tons. Other agricultural insecticides, with the exception of BHC, which is used against locusts, are of minor importance in Syria.

In 1949 the Ministry of Hygiene and Public Health instituted a program of public education in use of pesticides in Damascus. This program has resulted in increased use of household insecticides, particularly DDT, and in 1953 approximately 126 metric tons were imported.

Total consumption of all pest-control products in 1954 was about 1,000 tons, according to latest available statistics and estimates of trade contacts.

Foreign Trade

The United States provided around 60 percent of Syria's imports of agricultural pesticides in 1953. West Germany supplied about 16 percent, with the United Kingdom, France, Italy, and Belgium following in that order. Small quantities of household insecticides have been imported from Western European countries, but the United States supplies the major portion of DDT.

Table 64.—*Estimates of Syria's Consumption of Pesticides, 1953, 1954, and 1960*

[Metric tons—toxic ingredients]

	1953	1954	1960 (estimated)
Agricultural:			
BHC	100	50	75
Cotton dust (3–10–40)	150	200	300
Copper sulfate	5	5	10
DDT (100 percent basis)	10	3	5
Parathion	2	3	10
Fluosilicates	6	6	6
Lead arsenate	5	5	10
Petroleum oils	30	30	80
Sulfur	400	500	1, 000
Other products	25	25	50
Total	733	827	1, 546
Public health and household use:			
DDT (100 percent basis)	70	75	70
Other	50	50	70
Total	120	125	140

Equipment

Although there are few modern spraying and dusting units in Syria, this factor is not critical in limiting usage of pesticides. There is a small domestic production of hand dusters, but most equipment is imported. The importation of larger units for public health purposes is confined to the Ministry of Hygiene and Public Health and a few larger municipalities.

Marketing and Distribution

Common channels of distribution for agricultural insecticides are agents of individual foreign concerns and the Agricultural Bank. The Bank has been the sole purchaser of cotton dust, which is distributed through the Cereals Office. Public health and household insecticides are imported through exclusive agents and the Ministry of Hygiene and Public Health

United States pesticides, particularly sulfur and DDT (most competitive in price), are generally preferred to those of other supplying countries. Prices for many United States products are higher than for those from European countries. Also, European suppliers, especially West Germany, offer credit terms up to 2 years.

Normal advertising media, such as the press and radio, would not be effective in Syria, since any communication with farmers must be in Arabic. A more effective method would be to provide interested governmental and private organizations with promotional literature and samples of products to be used in actual field demonstrations.

Government Decrees and Regulations

Basic Syrian regulations governing distribution of pest-control products are contained in Legislative Decrees No. 40 of August 1, 1949, and No. 165 of March 12, 1952. The first of these decrees applies to the sale of chemical products and pharmaceuticals, including industrial insecticides; the second covers agricultural insecticides, chemical fertilizers, and veterinary products. In both instances, the importer or dealer must register his firm with the Ministry of National Economy. An importer of chemical products or pharmaceuticals must pay an initial registration fee of $85, renewable annually for $28. In the case of chemical fertilizers and agricultural insecticides, the fee is $28, renewable at $7. There are various other decrees of minor importance authorizing the Cereals Office to distribute agricultural insecticides, including cotton dust imported by the Agricultural Bank. The selling price of cotton dust is controlled in accordance with Legislative Decree No. 1378 of July 20, 1952.

Prospective Developments and Trends

There is no known prospect for manufacture of pesticides in Syria and no opportunity for investment of United States capital and technical know-how in such a project.

The essential problem in expanding use of pesticides is one of education. The Ministries of Agriculture and of Hygiene and Public Health only recently instituted a program of general education in the use of pest-control products and, until this information has reached the mass of Syrian people, consumption will not expand sharply.

Since price is of primary importance in this market and United States products are usually more expensive than competitive lines, liberal credit terms should be considered. Only through increased promotional efforts can United States producers meet the increasing competition of European suppliers and improve or even maintain their present position in the Syrian market.

Africa

Belgian Congo and Kenya are the two principal world suppliers of pyrethrum, which is in considerable demand since pyrethrum insecticides are nontoxic to humans. The Union of South Africa produces DDT and BHC, and copper sulfate is manufactured in Algeria and Egypt. Elsewhere in Africa there is little manufacturing or formulating of pesticides.

Africa is a steadily growing market for United States pesticides. Value of exports in 1954 were about 30 percent above those in 1953, and in 1955 were 58 percent higher than in 1954.

ALGERIA

(Based on report by E. B. Erickson, U. S. Consulate General, Algiers)

Production

The only pesticides produced in Algeria are copper sulfate and fluosilicates, both by the Societe Algerienne de Produits Chimiques et D'Angrais, Algiers. Annual output of copper sulfate is approximately 2,000 metric tons, about one-seventh of domestic consumption. About 75 tons of the fluosilicates are produced; only insignificant amounts are imported. Crude sulfur is imported and refined at three plants of Raffineries de Soufre Reunies, with annual production running from 18,000 to 20,000 tons.

Raw materials for production of pesticides include ethyl alcohol (a byproduct of the wine industry), available in large quantities; naphthalene (30 tons a year); benzol (100 tons a year); chlorine; and sulfuric acid (small amounts from domestic iron pyrites).

Consumption

See table 65 for annual consumption of pesticides in Algeria.

Major pesticide dealers estimate that approximately 84 percent of consumption is for agricultural use; 10 percent, industrial; 5 percent, public health; and 1 percent, household. It is not anticipated that consumption will increase significantly during the next few years. Some commodities being used experimentally may come into more general application, if found effective under local conditions.

Foreign Trade

See table 66 for foreign trade statistics. The largest portion of imports are from France, but the United States and European countries other than France supply materials not available domestically or from French sources.

Table 65.—*Average Annual Consumption of Pesticides in Algeria*

Commodity	Quantity (Metric tons)	Commodity	Quantity (Metric tons)
Anthracene and yellow oil	60	Pyrethrum (1 percent)	10
Barium fluosilicate	75	Rotenone (1 percent)	10
BHC and lindane	18	Sodium arsenate and arsenite	15
Copper sulfate	14, 000	Sodium cyanide	15
DD (dichloropropane and dichloropropene)	300	Sulfur	17, 500
DDT	160	2,4-D (technical basis)	50
Lead arsenate	20	Other (chlordane, zineb, parathion, captan, aldrin, dieldrin, etc.)	50
Methyl bromide	10		
Petroleum oils	560		
Polysulfides	200	Total	33, 053

Source: Algerian official statistics.

Equipment

Adequate spraying and dusting equipment is available and application of pesticides presents no special problem. Helicopters are used to a limited extent.

Marketing and Distribution

According to local dealers, United States pesticides are preferred, but French products will predominate so long as the dollar shortage exists. French products also have a price-wise advantage since no customs duty is levied on such imports, compared with 25 percent ad valorem on arrivals from other countries. Also, imports from foreign countries are subject to license.

Distribution of pesticides is by local agents. Production and distribution are free from government control except that the margin of profit on refined sulfur is fixed by government decree. Terms of sale are usually direct purchase both from French and foreign suppliers.

The best type of advertising media for promotion of pesticides is local agricultural trade journals of which there are a considerable number.

Prospective Developments and Trends

Prospects for increased participation by the United States in the Algerian pesticide market appear to be contingent on availability of

Table 66.—*Algerian Foreign Trade in Pesticides, 1953*

Commodity classification and principal countries of destination or origin	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Preparations of disinfectants, insecticides, fungicides, herbicides, etc.:		
Belgium	94, 577	31, 438
France	10, 215, 455	1, 563, 073
Germany	99, 648	51, 592
Italy	27, 117	5, 948
Morocco	5, 291	9, 962
United Kingdom	113, 316	40, 704
United States	520, 286	65, 111
Other countries	1, 396, 173	109, 762
Total	12, 471, 863	1, 877, 591
Preparations for agriculture and horticulture—France, total	769, 185	159, 141
Grand total	13, 241, 048	2, 036, 732
EXPORTS		
Disinfectants, insecticides, fungicides, cattle dips and sprays, and similar preparations:		
France	11, 243	6, 034
Tunisia	129, 630	21, 293
Other countries	47, 619	4, 240
Total	188, 492	31, 567
Preparations for agriculture and horticulture:		
Tunisia	7, 716	8, 648
Other countries	1, 543	1, 094
Total	9, 259	9, 742
Grand total	197, 751	41, 209

Source: Algerian official trade statistics.

dollar exchange. For products unavailable in France, the policy is to buy from OEEC countries, if possible, before resorting to the United States. Some pesticides purchased in France are manufactured by affiliates of United States firms, or by firms manufacturing in France under United States license. Probably this is the only means whereby United States capital and know-how can presently participate in the Algerian pesticide market.

ANGOLA (PORTUGUESE WEST AFRICA)

(Based on report by J. M. Kuhl, U. S. Consulate, Luanda)

Production

Pesticides are not manufactured in Angola. The economy of the country is based primarily on agriculture, mostly by native farmers who use primitive methods and know nothing of the benefits from use

of pest-control products. A number of European farmers use pesticides, but such consumption does not warrant production of these commodities in Angola, even if raw materials were available.

Consumption

Imports of pesticides amounted to 44 metric tons in 1946, declined from that figure for ensuing years, and in 1952 rose to 134 tons. It is believed that consumption of pesticides will continue to increase as farmers are educated to the benefits to be derived from use of these materials. Another factor favoring increased consumption is resettlement of Portuguese farmers in Angola. Each colonization project is staffed with agricultural engineers and agronomists who are familiar with pesticides and whose advice will undoubtedly increase use of pest-control products. It is possible that by 1960 consumption will approximate 300 tons a year.

Principal consumers are the large agricultural enterprises engaged in production of cotton, coffee, and sugarcane, and quasi-governmental organizations such as the Corn Guild. With the development of large-scale irrigation projects, consumption of pesticides can be expected to increase. Probably about 90 percent of pesticides is consumed in agriculture, 8 percent by public health services, and the remaining 2 percent for control of household insects.

Foreign Trade

Although imports of pesticides more than trebled in the period 1946–52, the United States share of the market decreased. The volume of United States products has remained fairly constant, but participation decreased from 47 percent to 21 percent in 1952. The shift has been toward pesticides of British manufacture, which increased from 18 to 47 percent in the same period. The Portuguese share of the market has remained fairly constant. The shift toward British pesticides has been the result of difficulty in obtaining import permits for United States products and the aggressive representation of two British companies operating in Angola. Discussions with importers reveal that United States products are preferred on the basis of price and quality, but imports are not licensed if the material can be purchased in Portugal or European Payments Union countries, even though dollar earnings are more than adequate for increased imports from the United States.

Equipment

Because of the limited use of pesticides in Angola, availability of spraying and dusting equipment is no problem.

Marketing and Distribution

Direct sale is the customary type of transaction for imports of pesticides.

All advertising material should be in Portuguese with appropriate reference to local conditions and infestations. For example, a circular letter advertising a pesticide should contain reference to the specific pests known to be troublesome, rather than make a general claim of protection.

Table 67.—*Imports of Pesticides into Angola, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Arsenicals for sprays and dips, total	22, 044	4, 596
Insecticides for treatment of cotton, total	5, 487	1, 268
Fumigants for trees and agricultural products, total	1, 784	1, 374
Other pesticides not specified:		
France	19, 063	5, 747
Germany	32, 628	12, 939
United Kingdom	90, 318	24, 591
United States	162, 809	31, 123
Other countries	42, 235	13, 356
Total	347, 053	87, 758
Grand total	376, 368	94, 996

Source: Angolan official trade statistics.

United States manufacturers of agricultural pesticides might use billboards, which are not common in Angola; the novelty of this method might produce results. Circular letters to prospective consumers of pesticides is also a recommended method of advertising, particularly when combined with company-sponsored demonstrations of the products.

Government Decrees and Regulations

No legislation is known regarding distribution of pest-control products.

Prospective Developments and Trends

The limited market would not appear to justify United States investment or technical knowledge in manufacture of pest-control products in Angola. A United States firm interested in entering the market should train a local representative in selling methods and provide him with demonstration materials and technical background.

The latter would be particularly effective in selling to German farmers who have some of the larger plantations and who appreciate technical information on the products they purchase. The agent should also work closely with the Government Agricultural Service, and such quasi-governmental organizations as the Corn Guild, the Cotton Commission, the Coffee Commission, and the Cereals Commission.

Weedkillers, in particular, should be readily accepted, as labor is in short supply; coffee growers especially might be quick to recognize chemical weedkillers as a partial solution to their labor problems. The adoption of irrigation and crop rotation by large plantations will gradually influence native farmers, and once pesticides are in general use by the more progressive agriculturists, their application can be expected to increase.

BELGIAN CONGO

Production

Up-to-date information on production and consumption of pesticides in the Belgian Congo is not available. Material in the Chemical and Rubber Division files indicates that, except for the growing of pyrethrum and a small amount of derris, manufacture of copper compounds (on a small scale) is the only pesticide production in Belgian Congo.

The country is one of the two major world producers of pyrethrum flowers and in recent years has supplied approximately half of United States imports of this insecticide material (see table 69 on Belgian Congo exports).

Consumption

Consumption probably closely approximates imports, which are rather sizable, with the United States as the principal country of origin (see table 68).

In the early 1950's it was estimated that output of cotton could be increased 30 percent if diseases and insects could be controlled. Coffee is also subject to insect attack, about 50 percent of the crop being involved annually.

A report of March 29, 1955, from the U. S. Consulate General at Leopoldville stated that "COGERCO" (Managing Committee for the Cotton Reserve Fund) had asked for bids on 2,595 metric tons of cotton insecticides, consisting principally of 5 percent DDT, 10 percent toxaphene, and 40 percent sulfur.

Foreign Trade

According to Belgian Congo trade statistics, the United States is the principal supplier of pesticides to that country, accounting for 70 percent in 1954.

Table 68.—*Belgian Congo Imports of Pesticides, 1954*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Disinfecting, insecticidal, fungicidal, weedkilling and similar preparations, and poison bait:		
With copper base:		
Belgium	21, 283	5, 003
France	27, 818	8, 444
United States	18, 206	4, 887
Other countries	9, 376	4, 574
Total	76, 683	22, 908
With sulfur base:		
Belgium	3, 812	402
United States	6, 686, 217	523, 899
Total	6, 690, 029	524, 301
With DDT base:		
Belgium	293, 968	27, 985
French Equatorial Africa	11, 199	5, 000
Germany	851, 255	121, 449
Kenya	47, 088	8, 543
Switzerland	242, 590	65, 213
United States	1, 352, 313	254, 776
Other countries	37, 977	21, 123
Total	2, 836, 390	504, 089
Wood-impregnating preparations:		
Belgium	38, 199	6, 958
France	57, 207	14, 914
Germany	294, 581	86, 224
United Kingdom	71, 389	6, 915
United States	127, 904	36, 297
Other countries	29, 820	3, 265
Total	619, 100	154, 573
Grand total	10, 222, 202	1, 205, 871

Source: Belgian Congo official trade statistics.

Equipment

No information on equipment is available.

Marketing and Distribution

Imports of pesticides are best handled through local agents. Purchases are usually made on a letter-of-credit basis. Government agencies do not distribute pesticides.

Importers use the usual type of advertising for pesticides—posters, newspapers, motion pictures, and radio.

Table 69.—*Belgian Congo Exports of Pyrethrum and Derris*

Commodity classification and principal countries of destination	Quantity (pounds)	Value (U. S. dollars)
Pyrethrum flowers:		
France	80, 428	23, 598
Germany	56, 932	16, 762
United Kingdom	41, 100	12, 042
United States	3, 471, 495	1, 020, 547
Other countries	28	18
Total	3, 649, 983	1, 072, 967
Pyrethrum powder, Germany	55	13
Derris root:		
Kenya	1, 162	71
Netherlands	4, 760	930
Total	5, 922	1, 001

Source: Belgian Congo official trade statistics.

Government Decrees and Regulations

As of 1950, there were no specific laws regulating importation or sale of pesticides in Belgian Congo. In the event of a dispute as to quality or standard, the Government General has an officially recognized laboratory at Leopoldville where pesticides can be analyzed.

Prospective Developments and Trends

No information is available indicating recent trends in the use of pesticides. The trend is believed to be decidedly upward, as well as toward newer and specialized products. In recent years, antimalarial campaigns have been undertaken and communal tanks for dipping animals have been established. In 1947, imports of pesticides into Belgian Congo totaled only 720,000 pounds, or less than 7 percent of the amount imported in 1954.

EGYPT

(Based on report by H. Lardicos, U. S. Embassy, Cairo)

Production

Two companies—Imperial Chemical Industries and Salmawy and Company—annually make about 7,000 metric tons of formulations based mainly on imported concentrates of BHC and DDT. Salmawy

and Company was expected in 1955 to produce 2,000 tons of BHC dust, 400 tons of 50 percent wettable DDT, and 120 tons of 50 percent wettable BHC, all to conform to World Health Organization specifications. In addition, petroleum marketing firms produce household insecticides based on deodorized kerosene and imported raw materials. Chemicals available locally for manufacture of pesticides include ethyl alcohol, chlorine, and sulfuric acid.

The Egyptian Government is building a plant in Kafr el Zayat for the manufacture of DDT. It is reported that the United Nations Children's Emergency Fund has contributed the necessary machinery and equipment at a cost of about $250,000. The plant is expected to begin production in 1956 and will have an annual capacity of 200 tons of technical DDT. The manufacture of nicotine sulfate from tobacco waste is under consideration.

Consumption

See table 70 for annual average consumption of the more important pesticides in Egypt.

Foreign Trade

Egyptian official statistics do not show separately imports of pesticides, but it is known that DDT, BHC, sulfur, oil emulsions, sodium cyanide, copper sulfate, carbon bisulfide, and weedkillers are imported. The quantity of DDT imported varies with infestations. Because of a serious cotton insect infestation in 1951, large quantities of cotton dust (DDT, BHC, and sulfur) were imported. However, no imports have been made since that time and large stocks still exist.

Table 70.—*Average Annual Consumption of Important Pesticides in Egypt*

Commodity	Quantity (metric tons)
BHC (13 percent gamma basis)	20
Calcium arsenate	190
Cotton dust (BHC–DDT–Sulfur)	500 (rough average)
Copper oxychloride	50
Copper sulfate	1,700 (200 for agriculture; 1,500 for "hygienic" use)
DDT (100 percent technical and 75 percent wettable).	250 (50 for agriculture; 200 for "hygienic" use)
Lead arsenate	25–30
Lindane	8
Paris green	8–10
Sodium cyanide	200
Spraying oils	400–500
Sulfur, dust	1,000
Sulfur, wettable	100–150
Toxaphene	60–70
Other pesticides	75

Source: Egyptian Ministry of Agriculture and trade sources.

Table 71.—*Egyptian Foreign Trade in Pesticides, 1953*

Commodity classification	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Insecticides, fungicides, disinfectants, sheep and cattle dips, and similar preparations	1, 821, 674	48, 174
EXPORTS		
Insecticides, fungicides, disinfectants, sheep and cattle dips, and similar preparations:		
Domestic materials	215, 645	19, 074
Reexports	53, 342	21, 140
Total	268, 987	40, 214

Source: Egyptian official foreign trade statistics.

Italy is the source of most of the sulfur; the United States, West Germany, France, and the United Kingdom are principal suppliers of other pesticides.

Equipment

A rudimentary type of hand sprayer is manufactured in Egypt, but most spraying and dusting equipment is imported, largely from the United States. Egypt experiences no difficulty in obtaining required equipment from abroad.

Marketing and Distribution

By far the largest importers and users of pecticides in Egypt are the Ministry of Agriculture and the Ministry of Public Health. Purchases by government departments are made by public tenders through local producers or firms which represent foreign manufacturers.

Usual terms of sale of European suppliers are direct purchase with credit terms ranging up to 3 months. United States manufacturers normally sell on irrevocable letter of credit.

The Egyptian Ministry of Agriculture maintains a Plant Protection Section concerned with preventive and control measures against plant pests and diseases. The Entomological and Plant Diseases Section of that Ministry recommends control measures. The Ministry of Public Health is in charge of preventive and control measures against pests which infest homes, hospitals, and public buildings.

Advertising media, including large posters and newspaper advertisements, commonly used in other countries, are successful in Egypt. At least two Egyptian firms marketing fertilizers and pesticides issue a monthly magazine which discusses agricultural problems and also advertises their products.

Government Decrees and Regulations

Law No. 509, issued September 30, 1954 (copy is on file in the Chemical and Rubber Division), governs trading in insecticides. To supplement the provisions of this law, the Egyptian Ministry of Agriculture is drafting (1954) regulations which will specify the components of each pesticide, its active ingredients, and respective proportions thereof.

Prospective Developments and Trends

Many Egyptian farmers are now aware of the advantages of using pesticides. As education along this line progresses and irrigated areas increase, consumption of pesticides will rise. One United States firm already is making available to an Egyptian distributor technical knowledge on preparation of formulations. There is an increasing tendency to produce formulations locally. Potential importers of pest-control products experience no difficulty in obtaining dollar exchange for United States pesticides, although in many cases they are required to pay premium rates (about 10 percent above the official rate in late 1954). The United States enjoys a high reputation in the field of pesticides and probably will continue to supply Egypt with toxic ingredients for these formulations, particularly those commodities not available from European sources. However, lower freight rates and faster delivery time have caused Egypt to buy important quantities of pesticides from European sources, particularly Germany.

To increase the Egyptian market, United States manufacturers, in cooperation with their local agents, should make on-the-spot experiments in conjunction with representatives of the Egyptian Government. Generous samples should be furnished local agents for distribution to farmers.

ETHIOPIA

(Based on report by C. T. Breaux, U. S. Embassy, Addis Ababa)

Production

With the exception of sulfur, a small amount of which is produced, all pesticides consumed in Ethiopia are imported.

Consumption

Principal pesticides in use are: Copper sulfate for spraying vineyards; BHC for control of locusts and for treating cattle hides prior to export; naphthalene for preserving hides; aldrin for combating

locusts; DDT and pyrethrum in household sprays; and rat poisons. With the exception of naphthalene, pesticides are not listed separately in trade statistics and distributors are unable even to estimate the amounts consumed. However, it is generally conceded that consumption has been rising and this increase is expected to continue at an accelerated pace in the next few years.

The U. S. Operations Mission has demonstrated the advantages of seed treatment and ground fumigations. Two recently established agricultural concessions have been experimenting in malaria control on a large scale, and a joint WHO-USOM-Ministry of Health operation is expected to be carried out against the malarial mosquito in the Gondar (northern Lake Tana) region. One of the two agricultural concessions also has been experimenting with weedkillers and termite-control products in its sugar fields. The prevalence of termites should create a large future demand for wood preservatives. Although the use of cattle dips against ticks is almost unknown, a large market will be created when Ethiopia improves the quality of its hides in order to meet competition in world markets. Protection of grain in storage also offers a large potential market. Consciousness of the financial cost of pests will eventually result from the efforts of USOM and the Pest Control Unit, established with USOM assistance in the Ministry of Agriculture, and demand for all pesticides should rise.

Foreign Trade

Less than $10,000 worth of pesticides were shipped to Ethiopia from the United States in each of recent years.

Distribution and Marketing

Poison for control of locusts is purchased by the desert locust control organization in London and distributed in Ethiopia through its Nairobi office. Other pesticides are distributed by local agents of foreign firms. Exchange control is no problem and the choice of pesticides for import depends on their effectiveness against various pests and diseases, as shown by public demonstrations. Several firms, aware of this trend, are supplying samples of their products to the USOM entomologist, the Ministry of Agriculture, and the large agricultural concessions.

The best advertising media are distribution of samples for controlled experiments and bulletins on the application of specific products and the result of experiments.

Government Decrees and Regulations

No Ethiopian legislation or regulations affect production or distribution of domestic and imported pesticides.

Prospective Developments and Trends

United States capital and technical knowledge might be used in the manufacture of pesticides with a powder base since inert ingredients are locally available. Since Ethiopia neither produces nor refines petroleum, it is doubtful that oil-base pesticides could be profitably produced.

Widespread use of pesticides will come gradually, as farmers and livestock owners realize the financial advantages to be derived from their use. United States products are popular and, as the market increases, participation by United States firms should rise.

FRENCH MOROCCO

(Based on report by W. C. Camp, U. S. Consulate General, Casablanca)

Production

The only pesticide produced in French Morocco is copper sulfate, manufactured by Compagnie des Produits Chimiques et Metallurgiques du Maroc and Metaux et Produits Chimiques, both in Casablanca. Copper sulfate production in 1952 was 1,200 metric tons, but in 1953 fell to 770 tons. Imports in 1952 totaled 439 tons and in 1953 were 101 tons, all from France. In 1952, French Morocco exported 466 tons of copper sulfate to France and Algeria; no exports were made in 1953.

All other pest-control products are imported, either in the form of packaged merchandise ready for use or as basic ingredients which are mixed and packaged by importers.

Consumption

Estimates of current consumption are not available and the only indication of demand (excluding copper sulfate) is derived from import statistics (see table 72). Imports should closely coincide with consumption since pesticides are not stocked in appreciable amounts.

The Protectorate's Agricultural Services utilize between 100 and 200 tons of BHC solution each year in its battle against locusts. Other functions of the Agricultural Services include rat extermination in rural areas and fumigation of imported plants and vegetables. Undoubtedly, consumption will increase, but it is impossible to indicate at what rate.

Foreign Trade

See table 72 for French Moroccan imports of pesticides in 1953. It is estimated that 60 percent of imports originate in France, with the

United States, United Kingdom, and West Germany providing the remainder.

Table 72.—*French Moroccan Imports of Pesticides, 1953*

Commodity	Quantity (in metric tons)	Commodity	Quantity (in metric tons)
BHC	13	Phenol derivatives	68
Calcium arsenate	11	Sodium chlorate	168
Carbon tetrachloride	25	Sulfur, refined	1, 668
Copper sulfate	101	Other (phosphatics, pyrethrum, cresol, etc.)	7
DDT	20		
Lead arsenate	11		
Naphthalene (refined)	32	Total	3, 330
Pesticide derivatives (packaged)	1, 206		

Source: French Moroccan official trade statistics.

Equipment

There is no shortage of spraying and dusting equipment and the most modern apparatus is available on the local market.

Marketing and Distribution

In general, the large French chemical industries (Kuhlman, Pechiney-Pragil, Rhone-Poulenc, and Auby) are firmly established in the Moroccan market since their representatives have country-wide distribution organizations. Pesticides are usually handled by companies dealing primarily in fertilizers and industrial chemicals. Importation of pesticides can be effected by the use of official exchange made available by the Government's Exchange Office specifically for such imports. A recent list of imports from dollar countries which can be so financed included $200,000 for agricultural insecticides.

Large-scale advertising is not employed by distributors, and occasional small advertisements in daily newspapers represent the practical limits of this sales technique. On the other hand, advertising literature mailed to chambers of agriculture, farm cooperatives, and governmental agencies constitutes a useful supplement to more direct methods of promoting sales.

Government Decrees and Regulations

Government regulations concerning pesticides are contained in a number of decrees, the most important being the Decree of December 2, 1922, regulating the importation, distribution, and use of poisonous substances. Pesticides produced and packaged in the United States, as well as those originating in most European countries, meet the standards required by these regulations.

Prospective Developments and Trends

Increased consumption of pest-control products is dependent on governmental programs, such as experimental and agricultural development projects, to educate the farmer regarding benefits to be derived from use of these commodities. There is no indication that production of pesticides will develop in French Morocco and increased United States participation in this market rests largely on meeting French competition and on the availability of dollar exchange for purchase of these commodities.

KENYA (BRITISH EAST AFRICA)

(Based on report by C. K. Bevilacqua, U. S. Consulate General, Nairobi)

Production

Pesticides are not manufactured in Kenya. Imported toxic ingredients are formulated into finished pesticides by African Explosives and Chemicals (East Africa), Ltd., and Plant Protection, Ltd. (both subsidiaries of Imperial Chemical Industries), and by Shell Chemical Company. Data on output are not available.

Kenya is one of the two major world producers of pyrethrum flowers. Production in 1954 was 2,549 long tons of dried flowers; the goal for 1956–57 is 3,500 tons. In 1954 the East African Extract Corporation converted 1,300 tons of dried pyrethrum flowers into extract (pyrethrin content not given).

Consumption

No information is available on consumption of pesticides in Kenya. However, import statistics should give an approximation of use (see Foreign Trade).

Foreign Trade

Kenya's foreign trade in pesticides in 1954 is shown in table 73.

Other Commodity and Economic Data

Information is not available on "Equipment," "Marketing and Distribution," "Decrees and Regulations," and "Prospective Developments and Trends."

Table 73.—*Kenya Foreign Trade in Pesticide Materials, January-November 1954*

Commodity classification	Quantity (pounds)	Value (U. S. dollars)
IMPORTS		
Disinfectants, insecticides, cattle dips and sprays, and similar preparations, total	3, 798, 400	808, 085
EXPORTS		
Pyrethrum flowers and powder	2, 371, 100	853, 474
Pyrethrum extract	144, 600	1, 393, 456

Source: Kenya official trade statistics.

LIBERIA

(Based on report by F. S. Wile, U. S. Embassy, Monrovia)

Production

No pesticides are produced in Liberia, nor is there any likelihood that such products will be manufactured in the near future.

Consumption

Data on consumption of pesticides are unavailable. However, statistics furnished by the U. S. Operations Mission and Firestone Plantations indicate the following amounts were used by these two organizations in the year ended September 30, 1954:

BHC:		
6.5 percent gamma dispersible powder	pounds	600
20 percent gamma emulsion	gallons	10
DDT:		
100 percent	pounds	300
30 percent emulsion	gallons	1, 590
Dieldrin:		
50 percent wettable powder	pounds	2, 400
20 percent emulsified concentrate	gallons	185
Dieldrex 15	gallons	55
Chlordane:		
50 percent water dispersible powder	pounds	150
100 percent	gallons	30
Aerosol bombs	units	2, 500

It is anticipated that the malarial program will be doubled by 1960 and, as a result, additional quantities of pesticides will be needed. With the change from a shifting agriculture to a family-type farm, insect and disease problems will increase and agricultural use of

pesticides should rise accordingly. However, it is not possible to give an estimate of future consumption.

Foreign Trade

Imports of pest-control products are grouped under "Insecticides, fungicides, etc." and only dollar value is given. Total imports were valued at $39,440 in 1953, with the United States as country of origin for $34,323, or approximately 87 percent. Pesticides are not exported from Liberia.

Equipment

The USOM indicates that lack of adequate spraying equipment is a serious handicap to malarial control work, nor is equipment available to make the best use of pesticides by the Liberian farmer.

Marketing and Distribution

A large percentage of pesticides used in Liberia is purchased either by large plantations or by such governmental organizations as the USOM. In order to sell to private consumers, United States manufacturers should have a representative or agent in Liberia to conduct demonstrations, followed by distribution of samples to farmers with instructions as to use.

Government Decrees and Regulations

No legislation exists which affects distribution of imported pest-control products.

Prospective Developments and Trends

Inasmuch as the United States commands the bulk of the present Liberian pesticide market, future prospects are largely dependent on increased consumption. Active competition from European producers could reduce existing United States participation in this market.

MOZAMBIQUE

(Based on report by Ralph W. Richardson, U. S. Consulate General, Lourenco Marques)

Production

Pest-control products are not manufactured in Mozambique. The economy of the Province is primarily agricultural, but the technical

level of agriculture is still quite primitive, and use of pesticides is limited; all supplies are imported.

With no domestic chemical industry, the only known raw materials available for production of pesticides are inert ingredients such as kaolin and kisselghur. One firm is establishing a mixing plant for fertilizers and pesticides and, beginning in 1956, will formulate 2,000 metric tons of insecticides a year.

Consumption

Official statistics on consumption are not available. From discussions with the two largest pesticide dealers in Lourenco Marques, it appears that of total consumption, about 60 percent comprises BHC-type insecticides, and 30 percent are DDT. According to the Department of Agriculture, the most widely used pesticides are BHC, DDT, bordeaux mixture, toxaphene, and petroleum oils. Estimates of distribution by principal uses are: Agriculture, 45 percent; veterinary services, 30 percent; public health, 21 percent; and household, 4 percent.

Assuming that present consumption is running approximately 400 metric tons a year (see "Foreign Trade"), it is believed that by 1960 at least 800 tons will be used annually. The Cotton Research Center has recently been conducting experiments on use of pesticides by native farmers who raise an annual cottonseed crop of approximately 100,000 tons. If these experiments result in higher yields per acre, there should be a relatively large increase in pesticide consumption.

Foreign Trade

See table 74 for statistics on 1953 imports of pesticides into Mozambique.

Major suppliers of pesticides in 1949–53 were the Union of South Africa and the United Kingdom, with the United States and Switzerland in third and fourth places.

Equipment

It appears that lack of training and knowledge on the part of both white and native agriculturists, plus low purchasing power, are the major limiting factors in the utilization of pesticides rather than lack of equipment.

Marketing and Distribution

Dealer-agents, usually in Lourenco Marques, the capital, or Beira, the second largest city, import and supply their branch offices in

smaller communities, or simply wholesale to various merchants through the Province. In all probability, more than 50 percent of pesticides are bought by various governmental organizations, so that bidding on government supply contracts is an important source of business. The government, in turn, supplies native and white farmers with pesticides through its system of agricultural extension agents.

Table 74.—*Imports of Pesticides into Mozambique, 1953*

Commodity classification and principal countries of origin	Quantity (pounds)	Value (U. S. dollars)
Arsenicals for sprays and dips:		
Union of South Africa	62, 106	12, 659
Other countries	63, 561	4, 848
Total	125, 667	17, 507
Fumigants for trees and agricultural products:		
United Kingdom	12, 103	6, 212
Other	43, 964	5, 880
Total	56, 067	12, 092
Other pesticides, not specified:		
Germany	12, 683	7, 227
Switzerland	32, 218	13, 006
Union of South Africa	394, 286	71, 799
United Kingdom	153, 319	20, 785
United States	56, 372	11, 350
Other countries	25, 980	4, 084
Total	674, 858	128, 251
Grand total	856, 592	157, 850

Source: Mozambique official trade statistics.

Only two advertising media exist in Mozambique—the press and radio. Several provincial daily and weekly newspapers frequently contain advertisements of agricultural pesticides and equipment. The monthly Gazeta do Agricultor (Farmers' Gazette), published in Lourenco Marques by the Department of Agriculture in cooperation with the Bureau of Veterinary Services, also is an excellent medium for advertising pesticides. A local agent for a Swiss firm has received considerable publicity by arranging for various demonstrations of its line of products and equipment at several of the government's agricultural experiment stations, to which prominent local officials and farm leaders as well as press representatives are invited.

Government Decrees and Regulations

At present, there are no laws or regulations controlling importation or use of pesticides in Mozambique. However, the Department of Agriculture and Bureau of Veterinary Services, the principal con-

sumers, are considering establishment of regulations on production and distribution of pest-control products.

Prospective Developments and Trends

Under present conditions, no opportunity exists for investment of United States capital or technical knowledge in production of pest-control materials in Mozambique. Future prospects for increasing United States participation in the market are contingent on the dollar-exchange situation, although many importers prefer United States products. Dollar imports, in general, are authorized only if goods needed are not obtainable elsewhere and are important to the economy of the Province. Also, local importers are generally reluctant to purchase on letter of credit, a requirement of many United States suppliers.

Since no fundamental change is foreseen in dollar-exchange supplies, the United States pesticide market probably will not increase, except for specialized products not obtainable from soft-currency countries.

UNION OF SOUTH AFRICA

(Based on report by M. A. McMaster, U. S. Consulate General, Johannesburg)

Production

Of the newer insecticides, only DDT and BHC are manufactured in the Union of South Africa and by only one firm—Klipfontein Organic Products, a government-controlled corporation having a $2,800,000 plant near Johannesburg. Erected during World War II to manufacture chemical warfare agents, at the close of the war, the plant shifted to production of DDT, later included BHC, and is now experimenting with manufacture of lindane. Current annual capacity is 600 long tons of DDT and 4,200 tons of BHC (probably technical basis).

There is also domestic production of bordeaux mixture, calcium arsenate, copper sulfate, copper oxychloride, and nicotine- and arsenic-base insecticides. The balance of requirements is supplied by local firms who formulate pesticides based on imported toxic materials and finished products. There are about 20 formulators, with 5 (2 are branches of United States firms) ranking as the most important.

Consumption

No official breakdown of consumption by commodities is available, but table 75 gives estimates obtained from the trade.

In addition to commodities listed in table 75, other products are

used in lesser amounts; for instance: ANTU, chlordane (use against termites and ants is increasing), DDD, dieldrin, lindane (demand is expanding), pyrethrum (supplied from Kenya), sodium arsenite (use decreasing), TEPP, and 2,4,5–T (widely used in small amounts).

Table 75.—*Estimated Annual Consumption of Principal Pesticides in the Union of South Africa*

Commodity	Quantity (Long tons)	Commodity	Quantity (Long tons)
Aldrin	40	Parathion (technical)	100
BHC	[1] 4, 200	Pentachlorophenol	750
Bordeaux mixture	[2] 250		*Gals.*
Calcium arsenate	50	Petroleum oils	500, 000
DDT	600	Sodium chlorate	250
Dithiocarbamate fungicides	100	Toxaphene	50
Nicotine and nicotine sulfate	100	2,4–D acid	200–250

[1] Capacity of Klipfontein; however, some amounts are exported.
[2] Not including that mixed on farms by the actual user.

The Union of South Africa is a relatively advanced market for modern pesticides. The acceptance and usage of recently developed products has been encouraged through local production, supplemented by importation of pesticides not produced in the Union. Consumption seems likely to show a sustained gradual increase during the next 5 years. Usage of certain agricultural pesticides is expected to rise sharply with increasing availability of spraying and dusting equipment.

Foreign Trade

See table 76 for information on 1953 imports of pesticides into the Union of South Africa. The Union is a substantial importer of technical ingredients such as aldrin, dieldrin, endrin, and parathion, as well as pyrethrum and sulfur. United States pesticides command a very favorable reputation and that country, with the United Kingdom, has been a leading supplier of technical materials.

West Germany and Italy have recently entered the pesticide field in the Union of South Africa and competition from a price standpoint is intense. Current requirements for aldrin, dieldrin, and endrin are supplied from the United States, but it is understood that, beginning in mid-1955, a new Shell Oil plant in the Netherlands will furnish these materials.

South African chemical production is generally gauged to include adjacent markets in the Rhodesias, Portuguese Africa, and British East Africa. Klipfontein Organic Products, however, has a marketing agreement (expiring at the end of 1955) with the Geigy Company to

furnish DDT to only domestic and Rhodesian markets. At present this company is negotiating for exportation of BHC to the Far East. Two large formulators are important suppliers of pesticides to the Central African Federation, Mozambique, and British East Africa.

Marketing and Distribution

The invoice required on all merchandise shipped to the Union of South Africa must show the true market value, cost of packing, insurance, and freight to the port of entry. Payment is generally effected by sight draft, but there is evidence that German and other European suppliers have been offering more favorable credit terms. This factor, in addition to price cutting, evidently explains the recent advance of German products in the South African market. Leading United States insecticide manufacturers are represented in the Union by local agents. South African manufacturers and formulators either maintain Union-wide sales organizations or appoint national or regional representatives.

Government Decrees and Regulations

Imports into the Union of South Africa are controlled under the Import-Exchange Control Program. Individual importers are restricted to a percentage of their import volume in 1948. With the recent improvement in the Union's balance of payments, import control is gradually being lifted. However, it is expected that items in the consumer-goods category will be the last to be freed of control.

Table 76.—*Imports of Pesticides into Union of South Africa, 1953*

	Value (U. S. dollars)
Disinfectants, germicides, antiseptics, and deodorants	445, 000
Substances for prevention of pests	1, 196, 500
Total	1, 641, 500

Source: South African official statistics.

There is stringent governmental control on the registration and sale of pesticides. Such products must be submitted to the Department of Entomology for approval and registration of both the commodity itself and the label appearing on the container.

Prospective Developments and Trends

The trend in South Africa is in the direction of expanded local manufacture of pesticides and at present there is a concerted effort, supported by the government, to expand the Union's production of industrial and commercial chemicals. Relaxation of import restrictions should permit increased United States participation in this market, particularly for products not now manufactured in the Union of South Africa.

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